



NCDA&CS
Plant Industry Division
Annual Report
2014



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NORTH CAROLINA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES



Mission Statement

The mission of the North Carolina Department of Agriculture and Consumer Services is to provide services that promote and improve agriculture, agribusiness, and forests; protect consumers and businesses; and conserve farmland and natural resources for the prosperity of all North Carolinians.

Steve Troxler
Commissioner of Agriculture
Chairman, Board of Agriculture

North Carolina Board of Agriculture



Maurice Berry



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Plant Industry Division

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ACCOMPLISHMENTS: ADMINISTRATIVE AND SUPPORT SERVICES SECTION

The NCDA&CS, Plant Industry Division state-appropriated budget for 2013-14 was \$3,646,218 and included a total staff of 92. For this fiscal year, there were significant increases in the phytosanitary fees collected by field staff. The Plant Industry Division continued its work with other organizations, both public and private, with the administration of cooperative agreements. For the period, approximately \$1,866,645 in cooperative agreements was received and administered for work with joint plant pest regulatory programs.

Organizationally, several other changes took place in the Plant Industry Division. Within the Plant Protection Section, changes were made to develop a Central Region Certification Specialist with supervisory oversight for central North Carolina counties. At the Raleigh level, a newly-defined Plant Pest Specialist position was established with direct responsibilities focused on plant pest related programs.

The Plant Industry Division, Support Operations Unit provides support for all the Division's programs, including staff and maintenance of Division owned vehicles and other equipment needed for all service and regulatory programs. This unit also assists the Division with the implementation of safety/seasonal employee orientation.

ACCOMPLISHMENTS: PLANT PROTECTION SECTION

The mission of the Plant Protection Section is to enhance the quality of life in North Carolina by protecting agriculture and the environment from injurious plant pests, by promoting beneficial organisms, and by protecting rare native plants of the state.

We serve the people of North Carolina by:

- Protecting agricultural crops, horticultural crops and native flora, by preventing or controlling the invasion and spread of injurious insects, plant pathogens, weeds, and other pests of regulatory concern.
- Protecting honey bees by combating the spread of bee pathogens.
- Responding to constantly changing threats to crops, rare native plants, and honey bees by drafting effective and reasonable regulations and by achieving public compliance.
- Supporting agriculture, horticulture and related industries by providing inspection and export services to facilitate the movement of regulated commodities.
- Protecting rare native plants by restoring their habitats, and by propagating and restoring them to the wild.
- Promoting beneficial organisms that serve as biological controls of pest species.
- Providing outstanding service and satisfaction to all our clients.

North Carolina has an extremely wide range of climate, from near tropical along the southeast coast to winter conditions similar to southern Canada in our higher mountains in the west. Such diversity provides suitable environments for an extremely diverse flora and fauna. Extensive international air and sea transportation, both military and commercial, and an extensive Interstate Highway System increase the potential for the accidental introduction of pest organisms into North Carolina. Therefore, North Carolina's Plant Protection Section programs must deal with a wide range of organisms and host-pest interactions.

Major program activities for the period January 1 through December 31, 2014 are described in the following reports.

Apiary Inspection Program

The primary mission of the Apiary Inspection Service is to maintain a viable beekeeping industry and ensure the productivity of North Carolina's diverse agriculture. The North Carolina beekeeping industry continues to remain viable and is expanding, particularly with new hobby beekeepers. Our inspectors assist beekeepers through field inspections, educational meetings and field days, and attempt to be available to assist the beekeepers in any way necessary. Our goal is to further improve our overall inspections and ultimately, to reduce the rate of honey bee disease and pest problems.



To protect the health of our honey bee industry, permits to sell bees are required for anyone wishing to sell queens, package bees, nucs, or hives. In 2014, 87 permits were issued to sellers in state and 15 to out of state dealers. To obtain a permit, bees must be inspected and the producers must agree to comply with standards designed to maintain healthy colonies. Beekeepers are strongly encouraged to buy only from permitted dealers to avoid buying unhealthy or Africanized honey bees. The permit list can be found at: <http://www.ncagr.gov/plantindustry/plant/apiary/documents/PermitToSell2015.pdf>.

One of the most devastating and difficult to control bee diseases is American foulbrood (AFB). Currently, the proportion of colonies with AFB to the total number of colonies inspected appears to be less than 1%. This demonstrates progress in controlling AFB. We have successfully maintained the Special Local Need 24(c) registration for the ethylene oxide (EtO) fumigation chamber and a source of the EtO formulation. We are currently providing decontamination service to the beekeepers of North Carolina with the chamber, and it is our belief that it is a valuable tool in controlling AFB as well as other serious pests and diseases.

Varroa destructor persists as a major threat to the beekeeping industry in North Carolina and is probably a contributing factor to general poor health or mortality of bee colonies. Several new miticides have been registered; however, the mites have developed resistance to some of these materials in short order and rendered these products ineffective. The most recently registered miticide, Apivar®, was registered in July 2013. This material seems to be working effectively for many beekeepers. Although chemical treatment of mites may be necessary, some miticides have been demonstrated to have adverse effects on bees. The growing use of unregistered materials may have adverse effects on honey bee health and may not be efficacious in controlling mites. This and, in some cases, the improper use of antibiotics to control diseases can further complicate useful treatment regimes.

Beekeepers are expressing concerns about pesticides, particularly the neonicotinoids. Bee yards can be registered through the Plant Industry Division. The list of registered yards is sent to Aerial Applicators licensed in North Carolina. For more information about registering, see: <http://www.ncagr.gov/plantindustry/plant/apiary/documents/2015ApiaryRegistrationForm.pdf>.

If a pesticide problem is suspected, timely reporting to an Apiary Inspector or the Pesticide Section is crucial for a valid investigation and resolution. The Structural Pest and Pesticides Division responded to reports of acute bee losses and followed up according to the evidence. Apiary personnel collected pollen samples from colonies suspected to be suffering sublethal effects of exposure to neonicotinoids. The samples contained no detectable levels of those chemicals. The Structural Pest Control and Pesticide Division and the Plant Industry Division are working with EPA to develop a Managed Pollinator Protection Plan.

Colony Collapse Disorder (CCD) remains a major topic of discussion among beekeepers. The press coverage has highlighted the value of honey bees to a broader audience and raised awareness of their importance. Our inspectors have seen colonies that share many of the symptoms attributed to CCD, but due to the restricted parameters described as symptoms of CCD, this disorder has not yet been documented in North Carolina. This is not to say that it has not occurred here, but we still have not seen evidence specifically attributable to this condition. Most of the colonies we have inspected that show symptoms correlating to CCD reveal evidence of high mite loads or other familiar disorders.

Another threat facing the beekeeping industry of North Carolina is the establishment of Africanized honey bees (AHB) (*Apis mellifera scutellata*) in southern Florida (and finds in Georgia). We are maintaining swarm traps at the ports of Wilmington and Morehead City in order to intercept any bees coming in via ship. We hope to expand this trapping system to some of our land-based points of entry. We continue to engage in an outreach program to North Carolina emergency response personnel to familiarize them with the potential threat of AHB. We are actively collecting samples of bees (particularly those from colonies with overly defensive behavior) to determine their geographic origin and their propensity for this behavior. The NCDA&CS and North Carolina State University are collaborating in conducting this survey. At this time, none of the samples collected have been determined to be of the AHB type. We are striving to have our inspectors and our lab prepared to deal with any AHB incursion or incident. **We encourage beekeepers and the general public to please let us know of any colonies that seem to be displaying any unusual behavior, especially excessive defensiveness. We want to maintain a beekeeping industry in North Carolina that is not threatened by the reputation of this more defensive type of bee.**

We continue to enjoy a good working relationship with our friends in the North Carolina State University Apiculture Research and Extension Program. We have had the opportunity to assist them in some of their projects and would like to express our gratitude for their assistance in many of our projects.

Biological Control Programs



CERCERIS FUMIPENNIS AND
PREY



HEMLOCK WOOLLY ADELGID



IMPORTED FIRE ANT AND
PHORID FLY



MILE-A-MINUTE VINE WEEVIL

The mission of the biological control program is to manage exotic pests using ecologically-based methods. We focus on classical biocontrol, reuniting exotic pests with the natural enemies that keep them below damaging levels in their home ranges. Although we are primarily an implementation program, conducting these projects requires research to ascertain the appropriateness of releasing biological control agents or to follow up on agents released. Currently, our projects focus on a variety of exotic insects and weeds, and involve laboratory rearing of insects, field releases of natural enemies, and surveying.

Our quarantine facility remains useful to our division as well as to outside cooperators as a secure space for research and monitoring of pests. Personnel working in the program during 2014 included Kathleen Kidd, Biological Control Administrator, Christine Nalepa, Research Specialist, Rebecca Norris, Research Specialist, David Bednar and Rebecca Fergus, Research Specialists for hemlock woolly adelgid rearing, and temporary employees David Allgood, Jimmy Cheatham, Saritha Dharanikota, and Whitney Swink. The Apiary Inspection Program is also based at the Beneficial Insects Lab, and Glenn Hackney, Research Specialist, maintains a lab at that location. Other Apiary staff are based at their homes across the state. During 2014, the inspectors were: Jack Hanel, mountains, Greg Farris, western Piedmont, Nancy Ruppert, Sandhills, Will Hicks, central counties, Adolphus Leonard, Coastal Plain, and Don Hopkins, State Apiarist and Apiary Inspection Supervisor.

Table 1 Summary of Biological Control Program Quarantine Activities 2013/2014

ID #	SPECIES	FAMILY	STAGE	#	ORIGIN	STATUS
Q10	<i>Piezordus guildinii</i> ¹	Pentatomidae	Eggs, nymphs and adults	300	AL, AR, LA, MS, MO, SC	Develop a diet for rearing.
Q9	<i>Imperata cylindrica</i> ²	Poaceae	Seeds	2 seed heads	NC	Devitalized by autoclaving.
Q8	<i>Miscanthus sp.</i>	Poaceae	Seeds	500	NC	Devitalized by autoclaving

A total of 3 shipments of foreign material were received by the NCDA &CS Insect Quarantine Facility during 2013/2014.

¹ Dr. Coby Schal, NCSU Entomology Dept., NCSU will utilize *Sirex* to hopefully develop semiochemical tools to facilitate early detection, population monitoring and ultimate control of *Sirex noctilio*.

² Seed heads from the Federal Noxious Weed *Imperata cylindrica* were examined to determine if any seeds present were viable.

Implementation of *Cerceris fumipennis* as a Biosurveillance Tool for Pest Buprestidae

Christine A. Nalepa and Whitney G. Swink

The solitary ground nesting wasp *Cerceris fumipennis* is being utilized as a biosurveillance tool for the efficient collection of pest buprestid beetles in Canada and in several locations in the eastern United States. In 2014 we continued our studies of the wasp in North Carolina, with the following goals:

- 1) Continue to locate sites with high nesting activity, particularly in areas at high risk of having emerald ash borer (EAB; *Agrilus planipennis*).
- 2) Collect and identify buprestid prey of *C. fumipennis*.
- 3) Continue studies of foraging behavior in *C. fumipennis*.

1) SURVEYS FOR NESTS OF CERCERIS FUMIPENNIS

Cerceris fumipennis prefers to nest in hard-packed, sandy soil that has sparse, short vegetation, is in full sun, and has some degree of human disturbance. Consequently, the nests are often found on baseball and softball diamonds. During 2014, we continued our survey of ball diamonds for nesting sites of *C. fumipennis* in North Carolina, concentrating our efforts in two categories of sites: 1) along I-85, a major thoroughfare in the state, and 2) re-surveys of sites from previous years; these either had ≤ 15 nests in previous surveys, or had been a biosurveillance site in the past but nest number had waned in recent years.

We concentrated surveys for new *C. fumipennis* nesting sites on ball fields located within two miles of I-85; the logic was that major highways frequently serve as conduits for spreading EAB.

Our first indication of *C. fumipennis* activity was on 23 May 2014, when two newly dug nests were observed at a site in Wayne Co. Surveys were initiated 16 June, allowing time for emergence of the majority of wasps at a given site, thus increasing our chances of identifying sites appropriate for biosurveillance. Discarded buprestids were found at several surveyed sites, confirming that the wasps were in their active foraging period; the survey was concluded on 26 June 2014.

A total of 169 ball fields in 88 sites in 17 counties were surveyed for nests of the wasp (Figure 1). Sixty-one of these (112 ball fields) were surveys of new sites. Of these, 28% were positive for nests of *C. fumipennis*, but just five had nest numbers that could justify re-survey and possible biosurveillance in 2015. The remaining 27 sites (57 ball fields) were re-surveys; 59% of these were positive for *C. fumipennis* nests. Five of the positive re-survey sites had high nest numbers ($n = 24, 70, 57, 30$ and 51 nests) and were also detected early enough in the season that biosurveillance was conducted during 2014.

Overall, 37% of the surveyed sites were positive for nests of *C. fumipennis*. Five of these were new or re-activated sites where biosurveillance was conducted in 2014. An additional five are new potential sites for biosurveillance in 2015. Results are summarized in Figure 1.

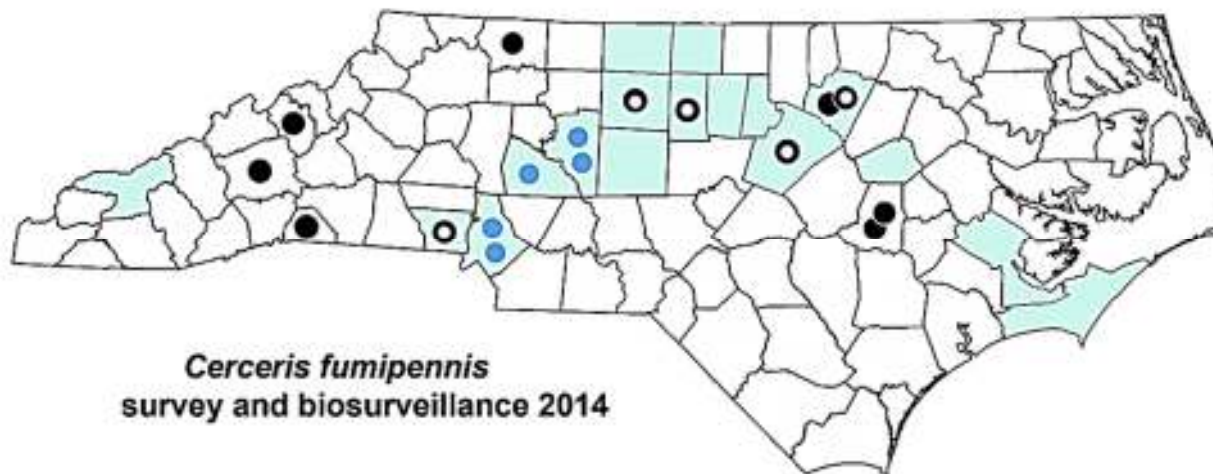


Figure 1 Survey for nests of *Cercheris fumipennis*, and biosurveillance using the wasp in NC counties. New surveys and re-surveys were conducted in shaded counties. Biosurveillance was conducted in known nesting sites (black dots) and in sites where re-surveys indicated a resurgence of nests (black-outlined dots). New nesting sites appropriate for biosurveillance in 2015 are indicated by blue dots.

2) COLLECTION OF BUPRESTID BEETLES FROM *CERCERIS FUMIPENNIS*

A total of 534 beetles were collected from *C. fumipennis* during the 2014 season, originating from 21 sites in 14 North Carolina counties (Alamance, Buncombe, Davidson, Franklin, Gaston, Guilford, Mecklenburg, Polk, Rowan, Surry, Swain, Wake, Wayne, and Yancey). The beetles were collected primarily (95%) from the 12 monitored biosurveillance sites (Figure 1); the remainder were collected as ‘drops’ (i.e., beetles discarded by the wasps) at survey sites (1-11 beetles at a given site). Five of the twelve biosurveillance sites met or exceeded the 50 beetle criterion for confident determination of all beetle species present within the foraging area of the wasp; the number of beetles collected at the remaining biosurveillance sites ranged from 6 to 39.

Identification to species level of all beetles is currently in progress, but includes at least 11 genera: *Acmaeodera*, *Actenodes*, *Agrilus*, *Brachys*, *Buprestis*, *Chrysobothris*, *Dicerca*, *Eupristocerus*, *Phaenops*, *Ptosima*, and *Spectralia*. No emerald ash borers (*Agrilus planipennis*) were identified in the collected material. To date (2009 to present), we have collected beetles from a total of 26 counties in North Carolina.

3) STUDY OF FORAGING ACTIVITIES IN *CERCERIS FUMIPENNIS*

In the summer of 2014 we continued studies of prey choice in *C. fumipennis*. Last year we established that the head capsule width of female *C. fumipennis* (n = 68) was significantly related to their wet weight, and described by the linear relationship: $\text{Weight (mg)} = -210.1314 + 72.244112 \times \text{Head Width (mm)}$ ($R^2 = 0.90$; $P < .0001$). The measure of head capsule width was therefore an appropriate measure of body size in the wasp, and we calculated predicted wet weight from wasp head capsule measurements during 2014.

We worked in eight geographically disparate aggregations of *C. fumipennis*. At each site, females returning from a successful foraging trip were captured with an insect net, her head capsule width measured using a Mitutoyo Absolute Digimatic caliper (0.01mm), and then released. The beetle she was carrying was collected and transported on ice to the laboratory. There the beetles were weighed using an Ohaus Explorer balance (.0001g), and the length of the beetle measured using the digital calipers. All measurements using the calipers were performed three times, and the average used in analysis. The study commenced on 28 May, and terminated 8 July 2014.

Results. Data on a total of 258 wasps were collected (Table 2). Statistical analysis is ongoing, but a few points can be made. Wasp size can display tremendous variation among sites; the average predicted weight of wasps in Site 1 was more than double the weight of those collected at Site 8 (Table 3).

Table 2 2014 study results of *Cerceris fumipennis* foraging behavior.

Dates	County	Site Number and Name	# Wasps and Beetles Measured
28 May – 6 June	Wayne	1. Wayne Community College	26
31 May – 11 June	Wayne	2. Faith Christian Acad	45
9 June – 14 June	Franklin	3. Franklinton Park	33
11 June – 15 June	Wake	4. Lake Lynn	47
16 June – 25 June	Surry	5. Meadowview MS	11
19 June – 23 June	Alamance	6. McCray Park	10
27 June – 8 July	Franklin	7. Luddy Park	51
24 June – 2 July	Buncombe	8. Vance Elementary	35
Total			258

Table 3 Average wasp weight, prey weight, and prey load (beetle weight/wasp weight).

Site	Mean \pm SD Predicted Wasp Wet Weight (mg)	Mean \pm SD Prey Beetle Wet Weight (mg)	Mean \pm SD % Body Weight Carried by Wasp
1	126.21 \pm 14.86	109.11 \pm 49.29	85.07 \pm 33.85
2	107.99 \pm 21.34	84.68 \pm 38.00	76.65 \pm 28.36
3	101.28 \pm 21.78	78.15 \pm 37.39	76.80 \pm 29.95
4	103.00 \pm 20.69	85.31 \pm 40.23	79.49 \pm 32.53
5	103.86 \pm 14.19	92.82 \pm 38.25	87.70 \pm 32.83
6	118.67 \pm 32.45	91.89 \pm 58.84	71.18 \pm 40.22
7	113.31 \pm 23.51	95.64 \pm 51.15	81.22 \pm 35.33
8	61.67 \pm 18.8	23.25 \pm 16.00	36.59 \pm 20.14
Overall	103.07 \pm 27.51	80.88 \pm 47.59	73.76 \pm 34.27

Wasp weight ranged from 29.7 to 159.0 mg. In general, prey weight varied with wasp weight (range of beetle weight: 3.5 to 216.4 mg), but the best model of the relationship was not a linear one (**Error! Reference source not found.**, top). All but the smallest females could carry more than their own body weight (**Error! Reference source not found.**, bottom); prey load ranged from 4.8 (*Agrius* sp.) to 150.2% (*Buprestis rufipes*) of wasp body weight.

Further analysis is ongoing and will incorporate species identity of all collected buprestids, as well as comparisons to published information on *Cerceris* foraging behavior.

Top: Prey beetle weight as a function of wasp weight. The relationship is best described with the quadratic equation (red line): Beetle wt. (mg) = $-59.19378 + 1.3317934 * \text{Wasp Wt. (mg)} + 0.0037293 * (\text{Wasp Wt. (mg)} - 103.066)^2$; $R = 0.55$, $P < 0.0001$

Bottom: Percent of her own body weight foraging *C. fumipennis* females were carrying (% wt. = beetle

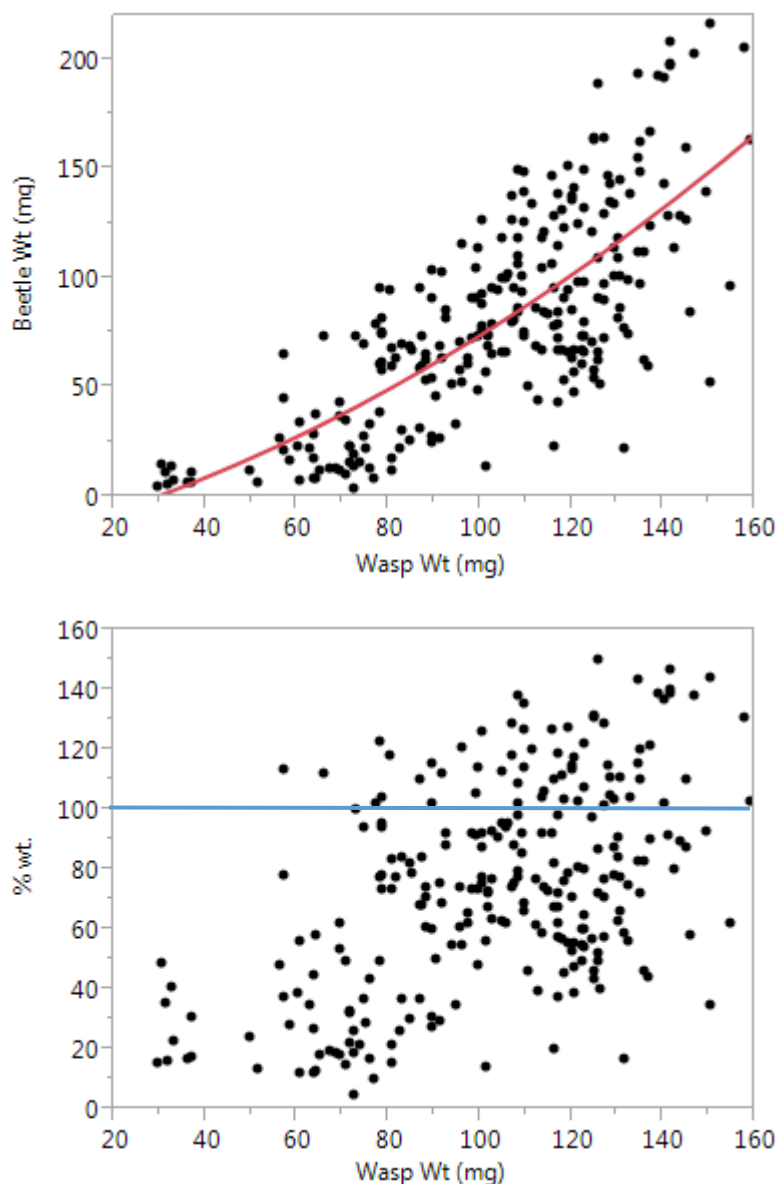


Figure 2 Relationship between wasp weight and beetle weight in foraging *Cerceris fumipennis*.

4) ADDITIONAL ACTIVITIES

One paper was published in a professional journal during 2014:

Swink, W.G., C. A. Nalepa, and J.P. Basham. 2014. Year-to-year variation of prey capture by *Cerceris fumipennis* (Hymenoptera: Crabronidae) at two sites in North Carolina. Ann. Entomol. Soc. Amer. 107(6): 1121-1125.

The *Cerceris fumipennis* survey program was twice featured in the NCDA & CS 'In the Field' blog during 2014: <http://info.ncagr.com/blog/?p=23024> and <http://info.ncagr.com/blog/?p=24572>

W.G. Swink presented results from the *C. fumipennis* biosurveillance project at the SAFEPS meeting in Crossnore 6-7 March 2014 ('Comparison of Buprestidae Collected by *Cerceris fumipennis* to Those Collected by Purple Prism Traps at Five Sites in North Carolina').

A poster and a talk was presented by C.A. Nalepa and W.G. Swink, respectively, at the Annual Meeting of the Entomological Society of America in Portland, OR, 16-19 November 2104:

Nalepa, C.A., and Swink, W.G.: 'Prey size selection by the buprestid hunting wasp Cerceris fumipennis'

Swink, W.G., Nalepa, C.A. and Basham, J.P.: 'Year-to-year variation of prey capture by Cerceris fumipennis (Hymenoptera: Crabronidae) at two sites in North Carolina'

Acknowledgements

We thank Rebecca Norris, Kathy Kidd, and David Allgood for help with the survey, and Rebecca Norris and the Master Gardeners and NCDA specialists that conducted biosurveillance: Alan Larkins, Phil Groves, David Pearce, Ginger Hemmings, and Sue Dial.

Hemlock Woolly Adelgid Predator Rearing

Kathleen Kidd and David Bednar

The primary objective for this project was for NCDA&CS to operate a large-scale central rearing facility to provide biological control agents for the management of hemlock woolly adelgid (HWA). *Sasajiscymnus tsugae* (St), native to Japan has been in mass production at the lab since December 2002. In 2012, our colony of beetles that originated from the original NJ colony and a 2008 collection from Japan crashed. Replacement beetles were supplied by Patrick Parkman of the Lindsay Young Beneficial Insect Lab of the University of Tennessee.

The hemlock woolly adelgid occurs over multiple states, and is now distributed throughout the native range of the eastern and Carolina hemlock species. Hemlock is widespread in National and State Forests and Parks, and the loss of the hemlock is causing major changes to the ecology of those areas. In addition to a loss of a unique ecosystem, dead and dying trees are a safety hazard in recreation areas, as well as aesthetically unattractive. Although some chemical control measures are recommended for specimen trees, control with insecticides is difficult in any setting and impractical to impossible in forest settings.



Figure 3 Dead hemlock trees in Linville Gorge, NC 2012

Because the hemlock stands and HWA infestations are scattered over a wide area, rearing and releasing large numbers of beetles in carefully-selected areas is preferred to relying on natural spread. A large-scale central rearing program supported by the USDA-Forest Service can provide these agents and coordinate releases for the southeastern region.

The predator beetles are well synchronized with the lifecycle of the adelgid. The adelgid becomes dormant for the summer as early stage settled nymphs, and in response, the beetles also enter a period of reproductive dormancy. At the end of aestivation period, when the adelgid began to mature and prepare for oviposition, hemlock boughs were stored in spring-like conditions to stimulate oviposition.

For mass production of the colony, mating groups of beetles were placed in 3.8 l jars supplied with a bouquet of hemlock twigs and three strips of gauze. Eggs (on the twigs and gauze) were removed weekly and put in rearing cages supplied with infested hemlock. Infested twigs and water were supplied and after 4 weeks, adult beetles collected and moved into storage cages. The scarcity of healthy HWA infested hemlock made it imperative that only necessary amounts were used in oviposition jars. The age and number of beetles, branches, and HWA were measured and varied to analyze optimum beetle oviposition. Oviposition jars for the 2013-2014 season were set up beginning 30 October 2013, with numbers of jars and beetles per jar increasing as egg-laying increased. Beetles were moved into storage cages until shipped to the Maine Forest Service. Oviposition concluded 13 June 2014. A small colony was maintained during the summer until new mating groups were assembled in the fall.

The number of beetles per jar tested throughout the rearing season were 15, 20, and 30 beetles with 66% female ratio. Jars included 5, 6, 7, 9, or 10 twigs, with 20cm of heavily infested area. The age of beetles was determined based on how long they had been in storage from the previous year. Exact emergence dates were unknown so beetles were placed in two groups, old and young. Oviposition jars were designated old or young to compare oviposition rates between these two groups. We did not control HWA numbers, but counted HWA on each branch before and after each week in the oviposition jar.

To assess quality control during the production season, a sample of 100 newly eclosed beetles was removed from a single cage each week. Beetles were separated by sex and weighed to the nearest mg.

Sasajiscymnus tsugae beetles regularly oviposited high numbers of eggs, but adequate material for rearing was scarce. Our contact with the USDA Forest Service was no longer able to obtain suitable material. We were able to collect from an abandoned nursery in Ashe County, until extremely cold winter weather in January killed most of the adelgids (~80%). Another lightly infested site was found in Burke Co., and regular collections from this location provided material.

During the production season, about 23,000 *S. tsugae* beetles were produced, and 7500 shipped to the Maine Forest Service for release. Although a low number of adult *St* were produced, egg production was optimized and very high numbers of eggs were produced. Egg releases may be preferable and more efficient to perform rather than using scarce hemlock resources to rear larvae through adulthood at low rates. Based on these data, more eggs were produced in some weeks than could be used with limited hemlock resources, resulting in even lower rearing efficiency when looking at total return (%).

In optimizing hemlock use and oviposition behavior, comparisons were made between beetle age groups, numbers of HWA per jar, numbers of twigs per jar, and numbers of beetles per jar. HWA counts demonstrated that adult beetles consumed a maximum of ca. 20 HWA/day. The data also showed that the number of HWA consumed was independent of the number of HWA available. Correlations between HWA/jar and beetle eggs produced showed that two factors significantly impacted the number of eggs produced per female beetles. Those two factors were the number of beetles (females), and the number of twigs in each jar. It was obvious the number of twigs per jar would affect the number of HWA present, and there were positive correlations between these two factors. However, when the number of beetle eggs produced was compared between twig numbers, it was clear that beetles laid more eggs when fewer twigs were present in the jars. The most *St* eggs were produced in jars containing 7 twigs regardless of HWA or beetle number. This finding allows for standardizing protocols to only include 7 branches in rearing jars. This change resulted in using less material during the rearing season. The next factor analyzed also showed that there were no significant differences in the total number of beetle eggs laid between groups containing 10, 14, and 20 females. This is significant in optimizing resources as well, knowing that 10 females will produce a similar number of eggs as 20 females in an oviposition jar. When analyzed further, the data show that there is a highly significant difference in the number of eggs laid per female, and that oviposition jars containing 10 females laid significantly more eggs per female than the other two treatments. These two findings show that fewer twigs and females per oviposition jar can increase the efficacy of rearing by limiting the amount of hemlock resources used and decreasing handling time. Finally, age effects were analyzed and there were significant differences in the number of eggs laid per week between the two groups. Oviposition jars containing beetles designated as “older” laid significantly more eggs than those with “young” beetles. Since beetle age was significant we have taken careful steps to maintain cohorts throughout the storage season and will further test this result

knowing the exact age of the beetles. This work was presented at the 2014 Southern Forest Insect Work Conference (SFIWC) in Charleston, SC.

Beetle quality was assessed by measuring beetle weights after emergence and sex ratios. Average female to male sex ratios for the entire rearing season were 1.49 which is within the natural range of 1 for this species of beetle. Average female weights for the entire season were 0.64mg which was more than that of males, at 0.59mg. These numbers seemed consistent with previous rearing season averages.

Personnel assigned to the project during 2013-14 rearing season include David Bednar, Research Specialist, full time, Rebecca Fergus, Research Specialist $\frac{3}{4}$ time, and David Allgood, Jimmy Cheatham, and Saritha Dharanikota Research Specialists, temporary employees. We thank Amanda Cook, Plant Pest Specialists for assistance with locating and collecting infested hemlock.

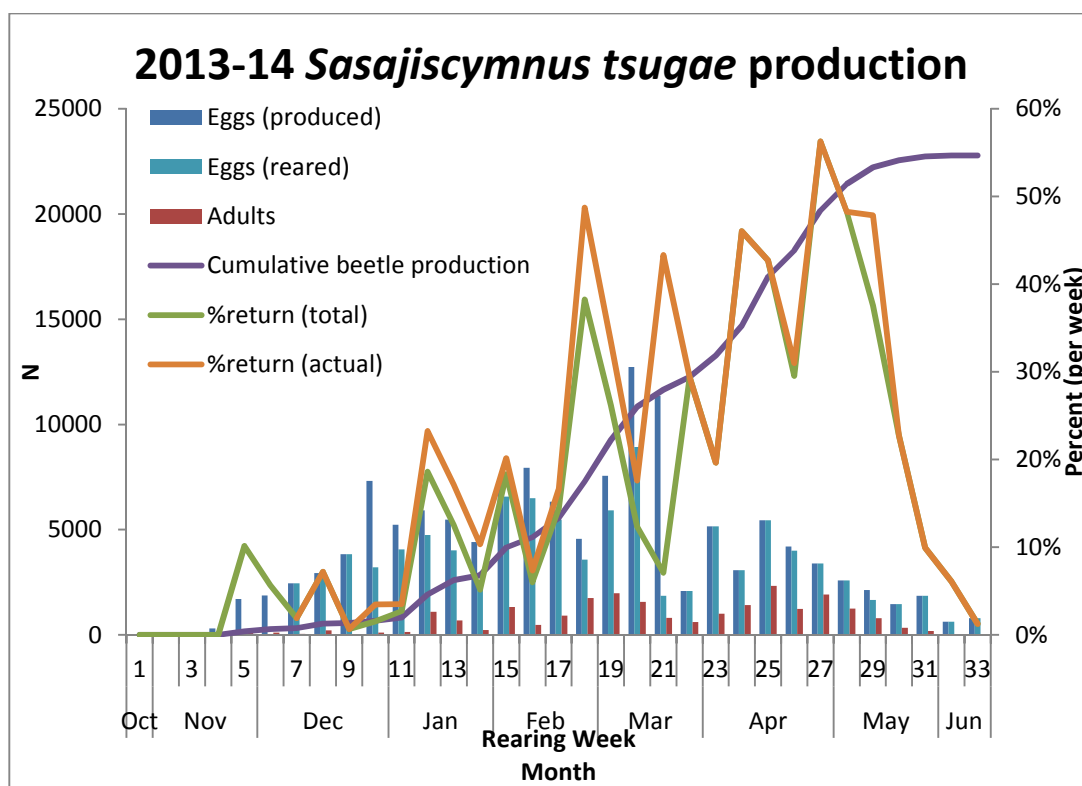


Figure 4 Egg and adult production, *Sasajiscymnus tsugae*, 2013-14, NCDA&CS

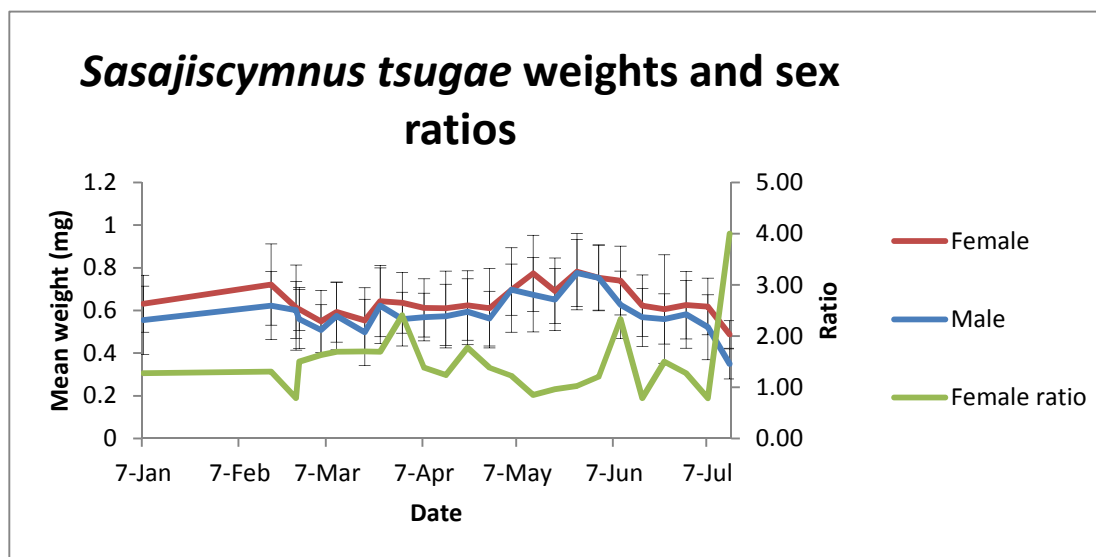
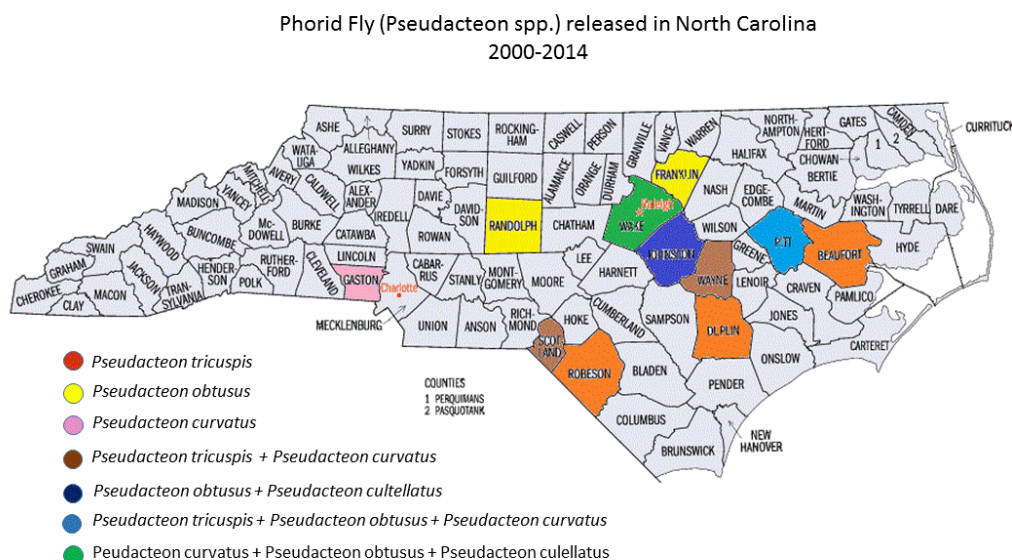


Figure 5 *Sasajiscymnus tsugae* weights (mg) and proportion of females, 2013-14, NCDA&CS.

Status of the field release and monitoring of phorid flies *Pseudacteon* spp for the imported fire ant

Rebecca Norris and Kathleen Kidd

Since the discovery of the imported fire ant (IFA) in North Carolina in 1953 it has spread to approximately 90 out of 100 counties (NCDA&CS, 2013). In an effort to slow the spread and decrease population size, biological control measures have been undertaken across the state. A complex of flies in the family Phoridae is known to attack *Solenopsis* spp. ants in their native South America (Porter, 1998). The phorid fly, sometimes referred to as the decapitating fly, lays individual eggs into worker ants while they forage or defend their mounds. After hatching, the fly larva moves into the ant's head to feed, and consumes soft tissue, eventually resulting in the ant's head falling off (Porter et al, 1995). When phorid flies are present, ants decrease foraging to avoid the flies. Less foraging activity results in fewer ants and smaller and/or fewer mounds, allowing native ants and other insects to better compete for resources (Mehdiabadi et al, 2004).

**Figure 6** Phorid fly releases by species.

Releases. Since 2000, 4 species of phorid flies *Pseudacteon tricuspidis*, *P. curvatus*, *P. obtusus* and *P. cultellatus* have been released in 11 counties of North Carolina (Figure 6, Table 4). The species of phorid flies selected for release at each locality was based on the most prevalent type of ant colonies present: monogyne colonies with one queen or polygyne colonies with multiple queens (Table 4). *P. tricuspidis* and *P. obtusus* flies typically attack larger workers usually found in the monogyne colonies whereas *P. curvatus* and *P. cultellatus* shows a preference for smaller workers common to polygyne colonies (Morrison et al. 1997).

In 2014, fire ants were collected from the Johnston County landfill 16 and 23 September (Table 4), and sent to the USDA ARS-CMAVE phorid fly rearing lab in Gainesville, Florida to be parasitized by the phorid flies *P. obtusus* and *P. cultellatus*. After exposure to the phorid fly the ants were shipped back to North Carolina and released into the mounds from which they were taken. An estimated 5077 *P. obtusus* and 4128 *P. cultellatus* were released.

Table 4 Site information for *Pseudacteon* Releases.

County	Year	Species	GPS Coordinates
Beaufort	2000	<i>Pseudacteon tricuspis</i>	35°41'53.52"N – 77°08'37.40"W
Duplin	2002	<i>Pseudacteon tricuspis</i>	34°59'37.97"N – 78°08'49.97"W
Robeson	2003	<i>Pseudacteon tricuspis</i>	34°35'49.61"N - 79°05'06.73"W
Wayne	2004	<i>Pseudacteon tricuspis</i>	35°23'26.95"N - 78°01'43.95"W
	2008	<i>Pseudacteon curvatus</i>	35°23'26.95"N – 78°01'43.95"W
	2005	<i>Pseudacteon curvatus</i>	35°47'24.89"N – 78°45'10.99"W
	2013	<i>Pseudacteon cultellatus</i> (Centennial Campus)	35°45'42.95"N – 78°40'47.55"W
Wake	2013	<i>Pseudacteon obtusus</i> (Wake Forest)	35°00'19.49"N – 78°32'06.16"W
	2006	<i>Pseudacteon tricuspis</i>	35°41'48.37"N - 77°30'32.99"W
	2010	<i>Pseudacteon obtusus</i>	35°37'54.71"N – 77°19'54.21"W
Pitt	2010	<i>Pseudacteon curvatus</i>	35°37'54.71"N – 77°19'54.21"W
	2007	<i>Pseudacteon tricuspis</i> <i>Pseudacteon curvatus</i>	34°51'05.83"N – 79°32'22.92"W 34°51'05.83"N – 79°32'22.92"W
Scotland	2007	<i>Pseudacteon tricuspis</i> <i>Pseudacteon curvatus</i>	34°51'05.83"N – 79°32'22.92"W 34°51'05.83"N – 79°32'22.92"W
Gaston	2009	<i>Pseudacteon curvatus</i>	35°10'54.46"N – 81°06'30.08"W
Randolph	2011	<i>Pseudacteon obtusus</i>	35°37'17.46"N – 79°45'19.32"W
Franklin	2012	<i>Pseudacteon obtusus</i>	36°04'15.93"N – 78°32'22.68"W
Johnston	2014	<i>Pseudacteon cultellatus</i>	35°30'51.61"N - 78°25'58.16W
		<i>Pseudacteon obtusus</i>	

Surveys (2014) A modified version of sticky traps developed by Puckett et. al. (2007) was used to monitor for *P. obtusus* and *P. cultellatus* in Pitt, Wake and Franklin County. The traps consist of plastic tri-stands (used to keep the pizza from sticking to the delivery box) glued to 60 x 15 mm plastic petri dishes. The pizza tri-stand and sides of the petri dishes were coated with Fluon™ to prevent the fire ants from escaping and climbing the tri-stand. Inverted tri-stands were anchored to the single tri-stand with Velcro, and the legs of the inverted stands were coated with Tanglefoot® (Figure 7). Traps were placed at or near the fire ant mounds and baited with live ants and bits of Vienna sausages to attract phorids. Flies became ensnared in the Tanglefoot® when they alighted to rest on the upright legs.

Monitoring: Surveys for the *P. obtusus* and *P. cultellatus* in Wake, Pitt and Franklin County were conducted in late July through October. A total of 70 traps were placed in Franklin County and at the Wake Forest location in Wake County, 10 traps in Pitt, and 30 traps on NCSU Centennial Campus in Wake County. Traps were retrieved one to two days after placement in the field. Flies collected were identified using ovipositor morphology.

**Figure 7** Sticky trap for capturing phorid flies.

Results: The only phorid flies detected this year on the sticky traps were *P. curvatus*. The extremely cold weather this winter and very dry conditions this summer may have impacted the establishment of *P. cultellatus* and *P. obtusus* in Wake and Franklin Counties. The population of *P. curvatus* is thriving in the 3 counties surveyed. Forty-two *P. curvatus* were present on a single sticky trap at the Centennial Campus site in October, 26 in Pitt County in August and 18 in Franklin County in early August. Phorid fly numbers on traps sharply decreased in September and October for the Franklin County site due to the lack of rain. The phorid flies *P. obtusus* and *P. tricusps* have not been detected in Pitt County for several years.

Monitoring for *P. obtusus* and *P. cultellatus* in Wake, Franklin and Johnston Counties will start in the Fall of 2015 when the phorid fly populations have time to increase.

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Mile-A-Minute Vine Biological Control

Persicaria perfoliata (L.) H. Gross, also known as mile-a-minute vine (MAM) is an exotic invasive plant, native to Asia. In the fall of 2010, several populations were reported in Alleghany County (Poindexter 2010). Since that report, additional locations were reported by citizens or through a survey of herbaria specimens. In 2011, homeowners in Watauga and Yancey Counties reported populations, and several widespread infestations were recorded in 2013. A small population in Guilford County was reported, while extensive infestations in Pasquotank, Perquimans, and Gates County were also found. A population was found along the Mayo River in Mayo River State Park, downstream from a known infestation. During 2014 Park Superintendent Keith Martin recorded several more populations along the river. No additional counties were found to be infested.

The widespread distribution of MAM, its prolific seed production, its growth over and in the midst of native plants, and its preference for riparian habitats made this weed an ideal target for biological control. A weevil, *Rhinoncomimus latipes*. Korotyaev, host specific to MAM was identified in China by entomologists from the USDA Forest Service and the University of Delaware (Hough-Goldstein et al. 2008a) (Figure 8). Weevil feeding on MAM produces several impacts on the plants. In addition to defoliation due to adult feeding and loss of apical dominance through larval feeding within stems, flowering and achene production is delayed (Hough-Goldstein et al 2008b). The weevils are now being reared at the Philip Alampi lab of the New Jersey Department of Agriculture (NJDA) and have been introduced in several states from Virginia to Massachusetts.



Figure 8 *Rhinoncomimus latipes* adult and damage on mile-a-minute vine, Alleghany Co, NC.

Since 2011, biological control of MAM has been underway in North Carolina. To date, we have released 14,700 weevils in 5 counties, and release sites are being monitored (Table 5). Dispersal from the original releases has been documented at multiple sites. Because *P. perfoliata* is an annual plant and grows from seeds in the spring, populations fluctuate from year to year. Sites along Elk Creek in Alleghany County have also changed with the amount of spring flooding and soil deposition.

Table 5 *Rhinoncomimus latipes* releases in NC 2011 – 2014

County	Date	Number	Location	Notes or Comments
2011				
Alleghany	12 May	500	Adjacent to US 221 & creek	Think understory, research plots
Alleghany	12 May	500	On hillside adjacent to woods	Small plants, research plots
Alleghany	26 May	200	Adj. to Elk Creek, nr Osborne Br.	Population low-moderate, plants small
Alleghany	9 Sept	200	Adjacent to Elk Creek	Moderate population of MAM
Alleghany	9 Sept	500	Natural area at end of road	Dense growth along Hawksnest Way
Alleghany	9 Sept	300	Near pond, Hawksnest Way	Nr jct Hawkwoods Ln & Hawksnest Way
Yancey	26 May	200	Adjacent to Coxes Creek & barn	Population low-moderate, plants small
	Total	2400		
2012				
Alleghany	20 Aug	600	Natural area at end of road	Dense growth
Alleghany	20 Aug	200	Near pond, Hawksnest Way	Nr jct Hawkwoods Ln & Hawksnest Way
Alleghany	20 Aug	200	Elk Creek Church Rd, nr Elk Ck	Roadside just past bridge over Creek
Alleghany	4 Sept	2000	Natural area at end of road	Dense growth, Hawksnest Way
Alleghany	4 Sept	1500	Near pond, Hawksnest Way	Nr jct Hawkwoods Ln & Hawksnest Way
Alleghany	4 Sept	300	Near Osborne Memorial Bridge	Population moderate, plants medium size
	Total	4800		
2013				
Alleghany	25 July	1000	Natural area	Dense growth
Alleghany	25 July	500	Near pond, Hawksnest Way	Nr jct Hawkwoods Ln & Hawksnest Way
Alleghany	15 Aug	1000	Adjacent to Elk Creek	Natural area, large population
	Total	2500		
2014				
Pasquotank 1	4 June	500	Roadside Ditch	Nr 1168 Turnpike Rd, NW side of Atlas Rd
Pasquotank 2	4 June	500	Timberland	Roadside
Pasquotank 3	4 June	500	Roadside ditch	Plants on both sides of ditch
Pasquotank 4	4 June	500	Harvested timberland	Very high population
Pasquotank 4	12 June	1500	Harvested timberland	Very high population
Pasquotank 5	4 June	500	Harvested timberland	Moderate to high population
Guilford	11 June	200	Roadside, nr power line ROW	Disturbed site – power line being rerouted
Rockingham	11 June	500	Sandy bank of Mayo River	Woods' edge, sandy beach in curve of river
Alleghany	13 June	300	Natural area at end of road	Dense growth, many weevils present
	Total	5000		
Grand Total		14,700		

One site had a small MAM population along Elk Creek in 2011 and 2012, but in 2013, it exploded into a dense thicket of MAM in a clearing near the creek. During a return visit in 2014, only a few plants could be found, but weevils were present. This year-to-year variability has also been noted at other sites, but at all of them, weevils are persisting. In 2014 weevils were numerous at the heaviest infestation on Hawkwinds Lane, and were also found about 0.6km from the Hawksnest Way sites that had had a high MAM density in 2013 followed by a sparse population in 2014.

Weevils have survived from one year to the next in Alleghany County, and have dispersed from their release locations. *R. latipes* can now be considered established in Yancey County as they have multiplied from the original 200 released, survived 3 winters, and weevils were found in 2014 approximately 2.7km from the release site. Notably, few plants were found at the original release site. Future work will involve survey for additional populations and spread of weevils.

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Cooperative Agriculture Pest Survey (CAPS) Program

The Cooperative Agricultural Pest Survey (CAPS) is a joint initiative between the USDA, APHIS, PPQ and the NCDA&CS to fund and implement domestic surveys of harmful or economically significant plant pests and weeds that have not been detected by front-line inspections at our ports of entry. These surveys safeguard our nation's agricultural and natural resources by detecting introductions or early pest infestations which are of concern to our trading partners. Typical surveys target exotic pests, pests of export significance, and pests that are not known to occur in the United States, but can also include regionally established pests. A strong domestic pest detection infrastructure and headquarters/regional staff is vital to ensuring that scientifically valid, current, and reliable pest/disease survey data is available on a continuing basis. Additionally, staff support is also critical at the state level, and federal funding provides for a State CAPS Survey Coordinator position housed within the NCDA&CS Plant Industry Division, Plant Protection Section.

Summary

In total, 839 individual samples were sorted from traps for 2014. Seven surveys were conducted; Exotic Woodborer and Bark Beetle, Oak Commodity, Grape Commodity, Asian Defoliators, Phytophthora and Solanaceous Commodity (ongoing). All surveys were conducted by NCDA&CS.

The 2014 season brought the addition of a newly discovered pest for our state. The psyllid, *Cacopsylla tobirae* (Figure 9) was confirmed in New Hanover County on pittosporum in June and was entered into NAPIS. This is a host specific pest and was previously found in the U.S. only in California in 2008.



Figure 9 Adult stage of *Cacopsylla tobirae* seen here resting on a *Pittosporum* (Pittosporaceae) leaf. The adult's last molt and the thread-like secretion common to the family Psyllidae can also be seen. Photo by Matt Bertone of the Plant Disease and Insect Clinic (PDIC).

The North Carolina CAPS Advisory Committee met on Thursday, June 19th 2014. The meeting focused on planning survey objectives for the upcoming 2015 season. The team consisted of the core members of the state CAPS committee as well as members from North Carolina State University, North Carolina Forest Service and other members from the North Carolina Department of Agriculture and Consumer Services. Survey priorities for 2015 were determined and a general survey plan was made so overlap would be minimal or non-existent across programs. These new survey project proposals were submitted through CAPS and Farm Bill by the State Survey Coordinator (SSC).

Survey Breakdown

The following surveys (exotic wood borer and bark beetle, oak commodity, Asian defoliators, grape commodity, solanaceous commodity and phytophthora) were completed during the 2014 surveying season. The season began in March with the exotic wood borer and bark beetle survey.

Exotic Wood Borer and Bark Beetle

North Carolina was involved in the exotic wood borer and bark beetle survey for the 2014 season. There were several bark beetles that were targeted throughout the state; the six-toothed bark beetle (*Ips sexdentatus*), European spruce bark beetle (*Ips typographus*), and pine shoot beetle (*Tomicus piniperda*) (Figure 10). These are serious pests that pose a threat to North Carolina forests and timber industry. More than 5,000 specimens were identified with help from PDIC (Table 6).

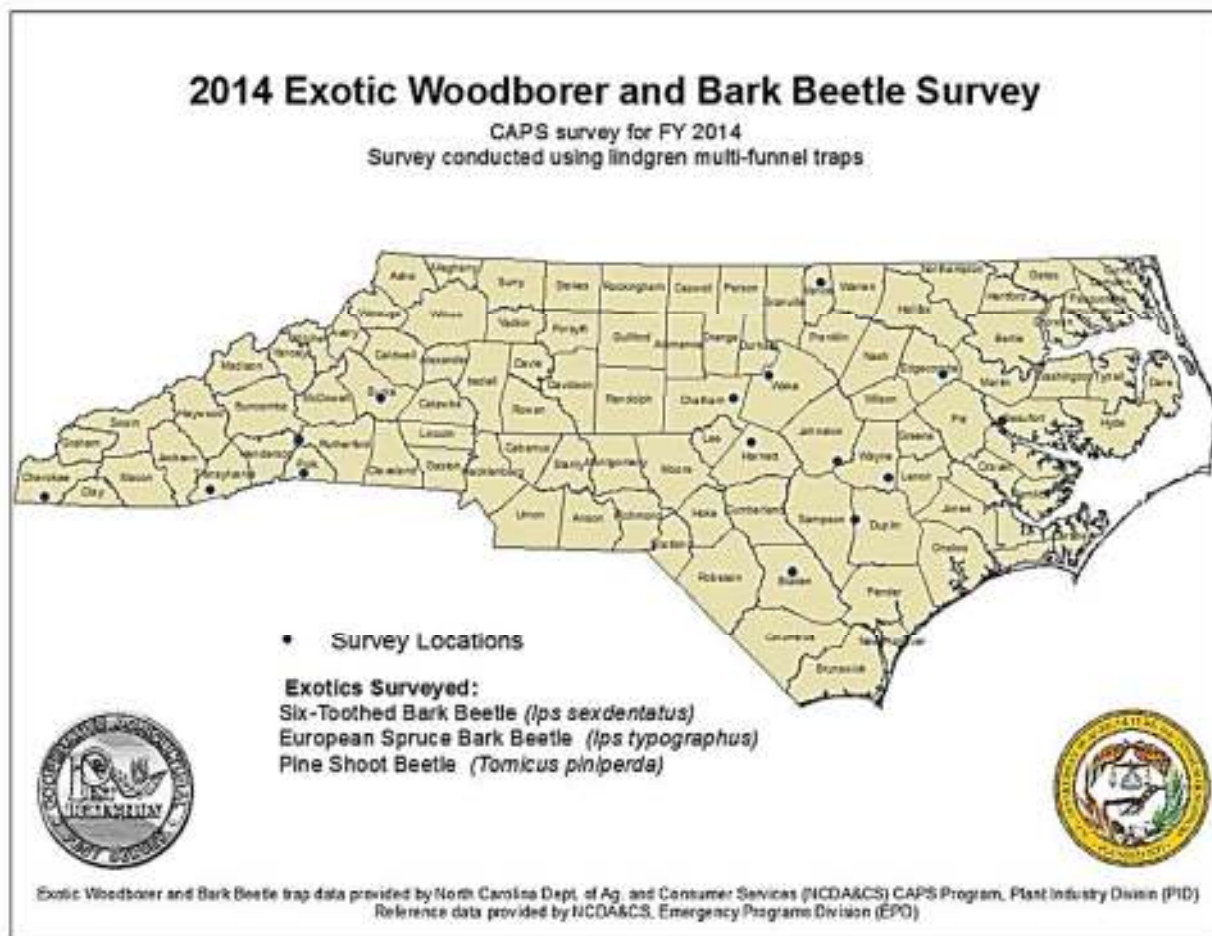


Figure 10 Exotic wood borer and bark beetle survey locations.

This survey lasted through September. The timing of trap placement was dependent on target species. The exotic wood borer and bark beetle survey focused on state parks, rest stops, log yards and other private and public land. A total of 16 trapping locations completed the survey for the targeted pests. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

Table 6 Identification of all bark beetle specimens after initial sorting.

Specimens were identified with help from North Carolina State University's Plant Disease and Insect Clinic (PDIC).

Genus and Species	Total Number	Genus and Species	Total Number
<i>Xylosandrus crassiusculus</i>	4015	<i>Ips avulsus</i>	4
<i>Xylosandrus germanus</i>	276	<i>Xyleborinus gracilis</i>	4
<i>Xyleborinus saxesenii</i>	164	<i>Ambrosiodmus rubricollis</i>	3
<i>Hylastes tenuis</i>	108	<i>Cnestus mutilatus</i>	3
<i>Ambrosiophilus atratus</i>	86	<i>Cyclorhipidion bodoanum</i>	3
<i>Ambrosiodmus obliquus</i>	85	<i>Hylocurus rudis</i>	3
<i>Xyleborus intrusus</i>	74	<i>Hypothenemus crudiae</i>	3
<i>Hylastes salebrosus</i>	68	<i>Hypothenemus intersitialis</i>	3
<i>Xyleborus pubescens</i>	61	<i>Xyleborus xylographus</i>	3
<i>Xyleborus affinis</i>	50	<i>Cnesinus strigicollis</i>	2
<i>Euwallacea validus</i>	46	<i>Dendroctonus valens</i>	2
<i>Hylastes porculus</i>	36	<i>Lymantria decipiens</i>	2
<i>Dryoxylon onoharaensis</i>	24	<i>Orthotomicus caelatus</i>	2
<i>Dendroctonus terebrans</i>	20	<i>Corthylus punctatissimus</i>	1
<i>Gnathotrichus materiarius</i>	16	<i>Hypothenemus dissimilis</i>	1
<i>Ips grandicollis</i>	12	<i>Ips calligraphus</i>	1
<i>Monarthrum mali</i>	12	<i>Monarthrum fasciatum</i>	1
<i>Xyloterinus politus</i>	6	<i>Pseudopityophthorus minutissimus</i>	1
<i>Anisandrus sayi</i>	4	<i>Xylosandrus compactus</i>	1
<i>Hypothenemus erectus</i>	4		
		Total Species	39
		Total Count	5210

Oak Commodity Survey

Under the oak commodity, North Carolina surveyed for oak splendor beetle (*Agrilus biguttatus*), variegated golden tortrix moth (*Archips xylosteanus*), false codling moth (*Thaumatotibia leucotreta*), oak processionary moth (*Thaumetopoea processionea*), and green oak tortrix moth (*Tortrix viridana*). Trapping for this survey began in May and ended in September.

Combined, this group of invasive pests represents a significant threat to the economic, agricultural, and environmental well-being of North Carolina. Together, they have an impressive host range and include nursery stock, cut flowers, stone fruits (peach, plum, cherry, etc.), pome fruits (apple and pear), grape, elm, ash, maple, oak, blackberry, cotton, honeysuckle, lilac, rose, strawberry, blueberry, rhododendron, corn, okra, pepper, sorghum and other host species.

This survey utilized several trap types including the purple prism, wing and delta traps and was conducted in private nurseries, state parks and public and private land. Samples were screened for the presence of all target pests by the SSC with help from PDIC. A total of 15 locations were selected throughout the state (Figure 11). At the time of servicing for lure replacement, samples were taken and sorted by the SSC. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

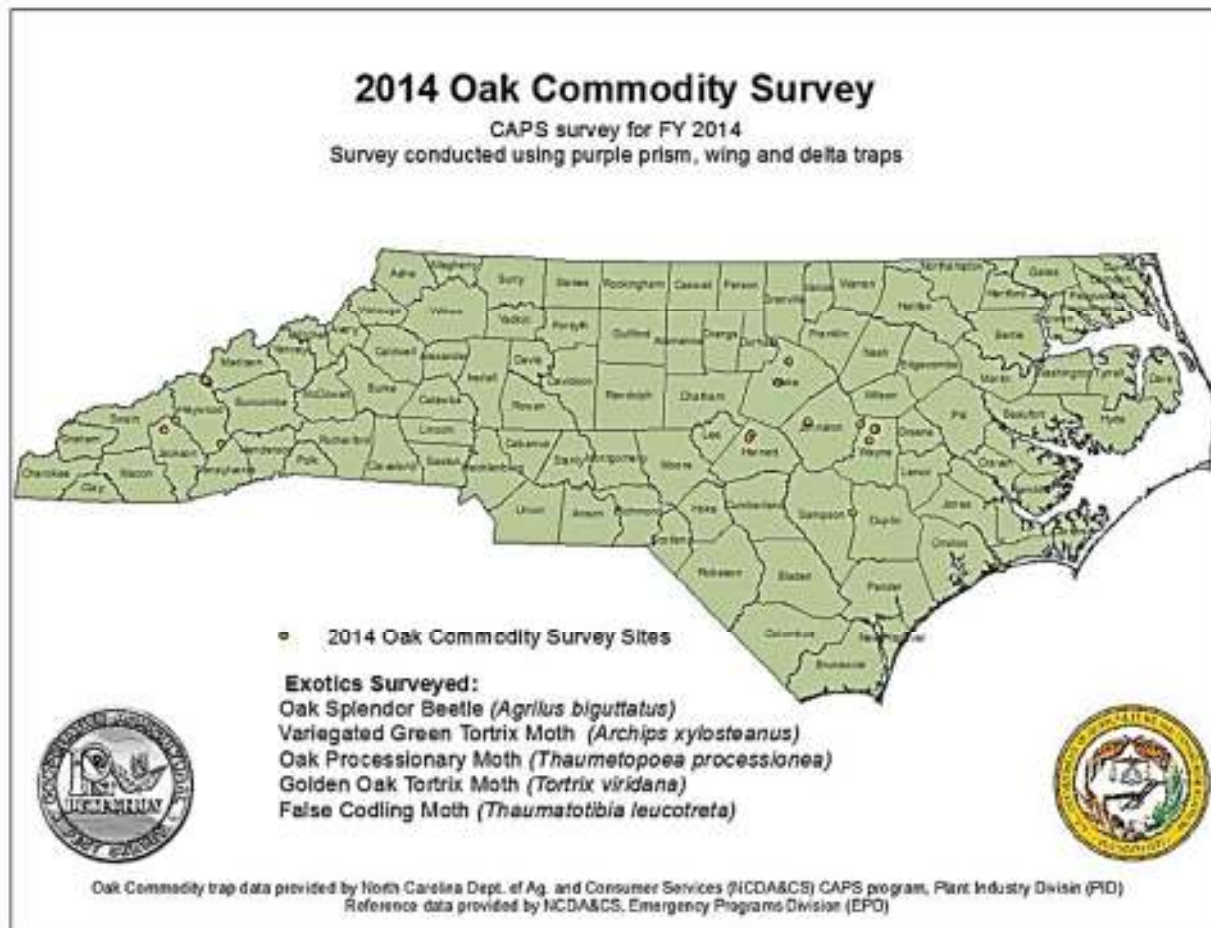


Figure 11 Oak commodity survey locations.

Asian Defoliators

Survey locations for Asian defoliators were concentrated at Ports of Entry (POE), military installations, rail yards and highway rest stops (Figure 12). Introduction of exotics under this banner would have serious implications for North Carolina forests. Host trees for these pests are considered economically important and include oak, pine, ash, elm, maple and walnut.

Traps were placed in June and pulled in September with monthly site visits for trap maintenance and lure replacement. Effort was made to gain access to military installations in eastern North Carolina. To help with this endeavor, contacts were given to the SSC by the USDA-APHIS-PPQ Pest Survey Specialist. Multiple survey locations reside on these large installations, and may include a combination of several forms of conveyance including deep water ports, rail yards, or airstrips. Four military installations were visited in 2014.

Six exotic species were surveyed; Asian gypsy moth (*Lymantria dispar asiatica*), pink gypsy moth (*L. mathura*), nun moth (*L. monacha*), pine tree lappet (*Dendrolimus pini*), Masson pine Moth (*D. punctatus*) and Siberian silk moth (*D. sibiricus*). These exotics attack hardwood as well as coniferous trees. With 2014 detections of Asian gypsy moth in several states including Charleston, South Carolina we will continue to survey under this umbrella. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

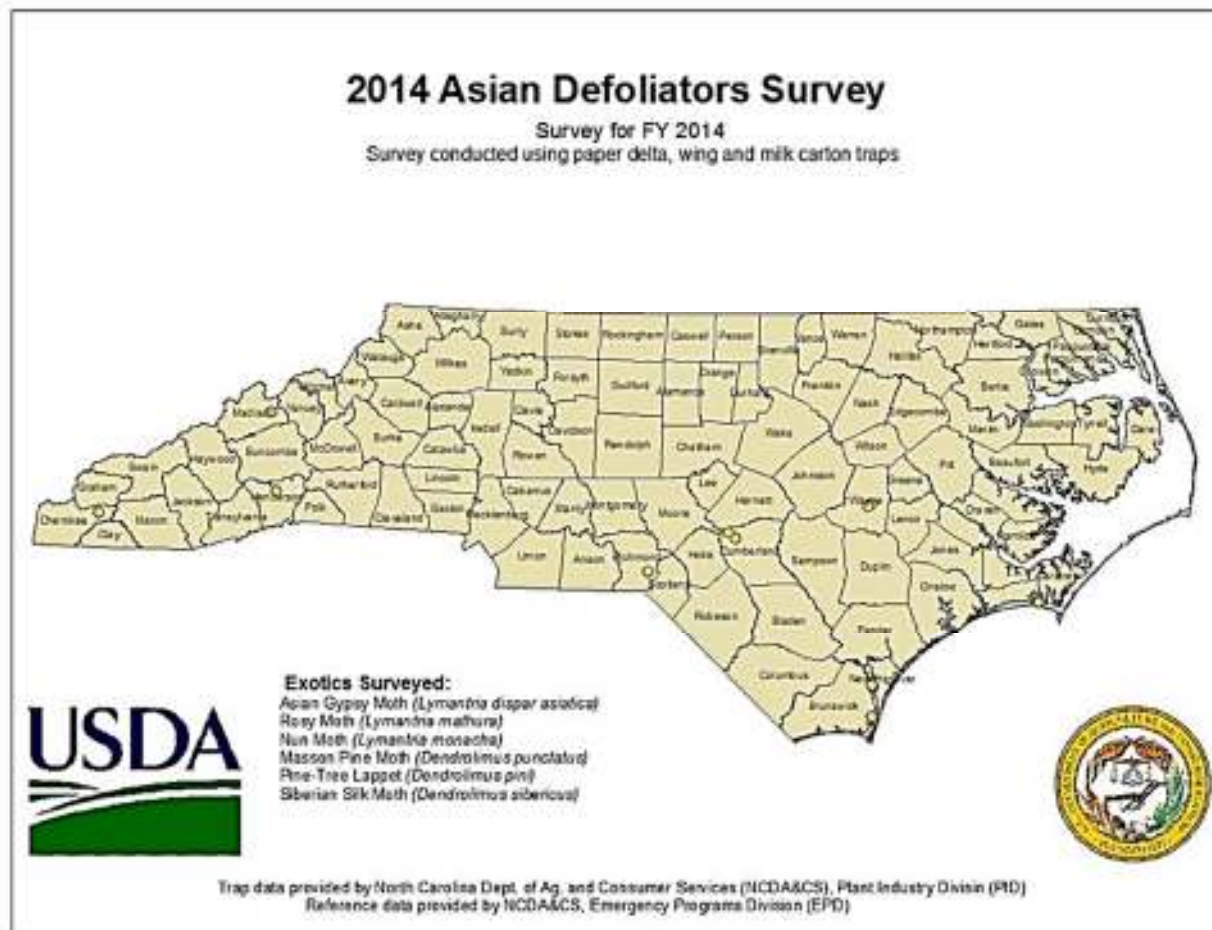


Figure 12 Asian defoliators survey locations.

Grape Commodity

The primary objective of this project was to survey for exotic pests of the grape commodity (*Vitis vinifera* and *V. rotundifolia*) in production areas. We surveyed for five exotic species; summer fruit tortrix moth (*Adoxophyes orana*), light brown apple moth (*Epiphyas postvittana*), European grapevine moth (*Lobesia botrana*), Egyptian cottonworm (*Spodoptera littoralis*) and cotton cutworm (*Spodoptera litura*). The survey was completed using Jackson, delta and bucket traps that were placed in June and pulled in September. Trapping was spread throughout the state with nine locations (Figure 13), over the four month period. Samples were collected at the servicing of each trap and screened for the presence of these pests by the SSC. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

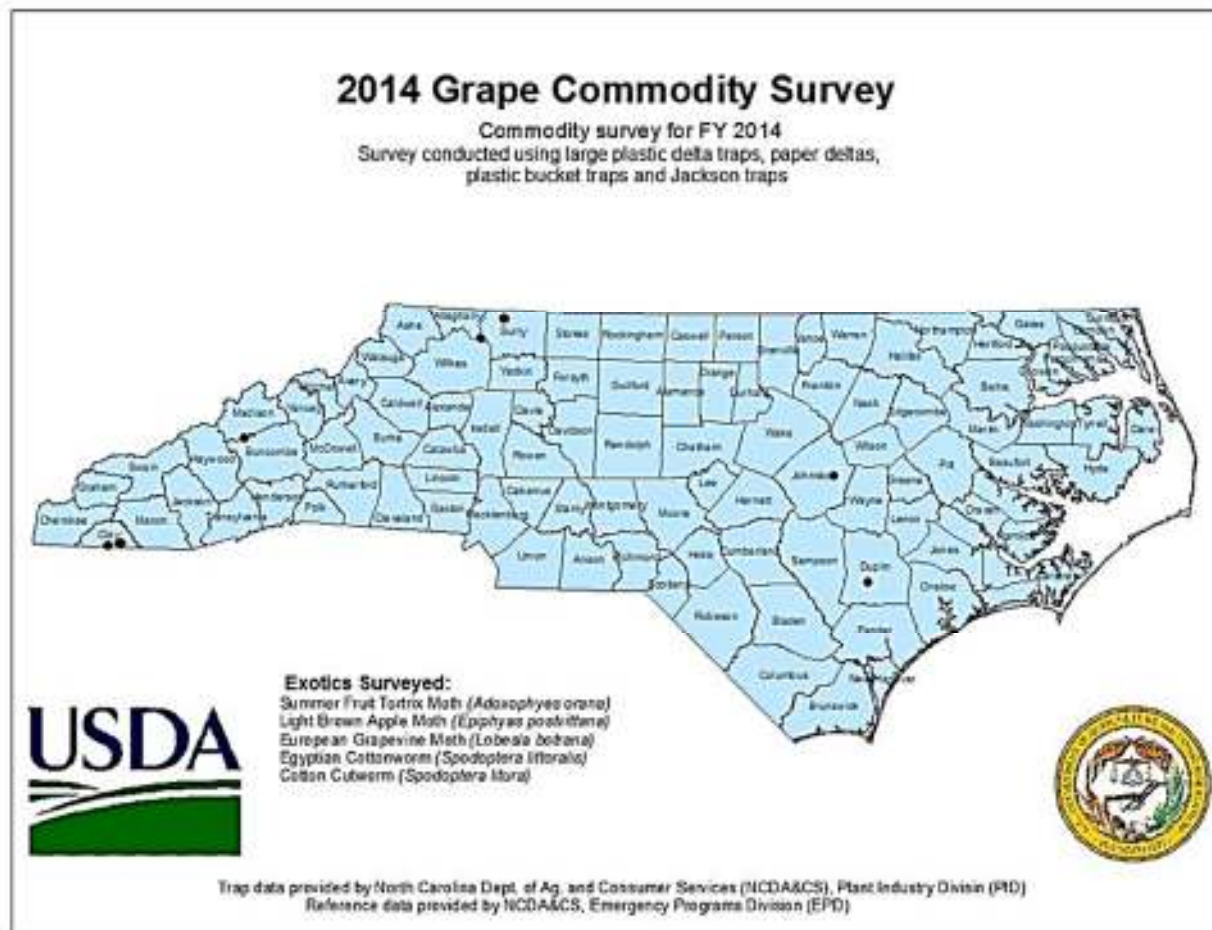


Figure 13 Grape commodity survey locations.

Solanaceous Commodity (2013 Extended)

The primary objective of this project was to survey for the exotic pest *Tuta absoluta*, tomato leafminer, throughout North Carolina's tomato production areas. A three month extension was granted for the 2013 agreement to continue this survey beyond the June 2nd, 2014 reporting period to include a full season instead of a partial. This allowed for additional trapping of tomato fields and included home improvement stores as well as commercial operations that markets tomato seedlings. The introduction of this pest into North Carolina would have serious consequences for our commercial tomato growers.

Tuta absoluta is a species of moth in the family Gelechiidae known by the common names tomato leafminer and South American tomato moth. In favorable weather, the moth is capable of producing eight to ten generations per year. First known as a tomato pest in South America, it was identified in Spain in 2006. It is well known as a serious pest of tomato in Europe and South America for its voracious appetite of tomato plants, producing large galleries in leaves, burrows in stalks, and consuming terminal buds and green and ripe fruits. This pest is capable of causing 100% crop loss. In addition to tomato, hosts include potato, eggplant, pepper and other solanaceous plants. This pest has spread to every country bordering the Mediterranean and also Saudi Arabia, Iraq, Switzerland, and the United Kingdom.

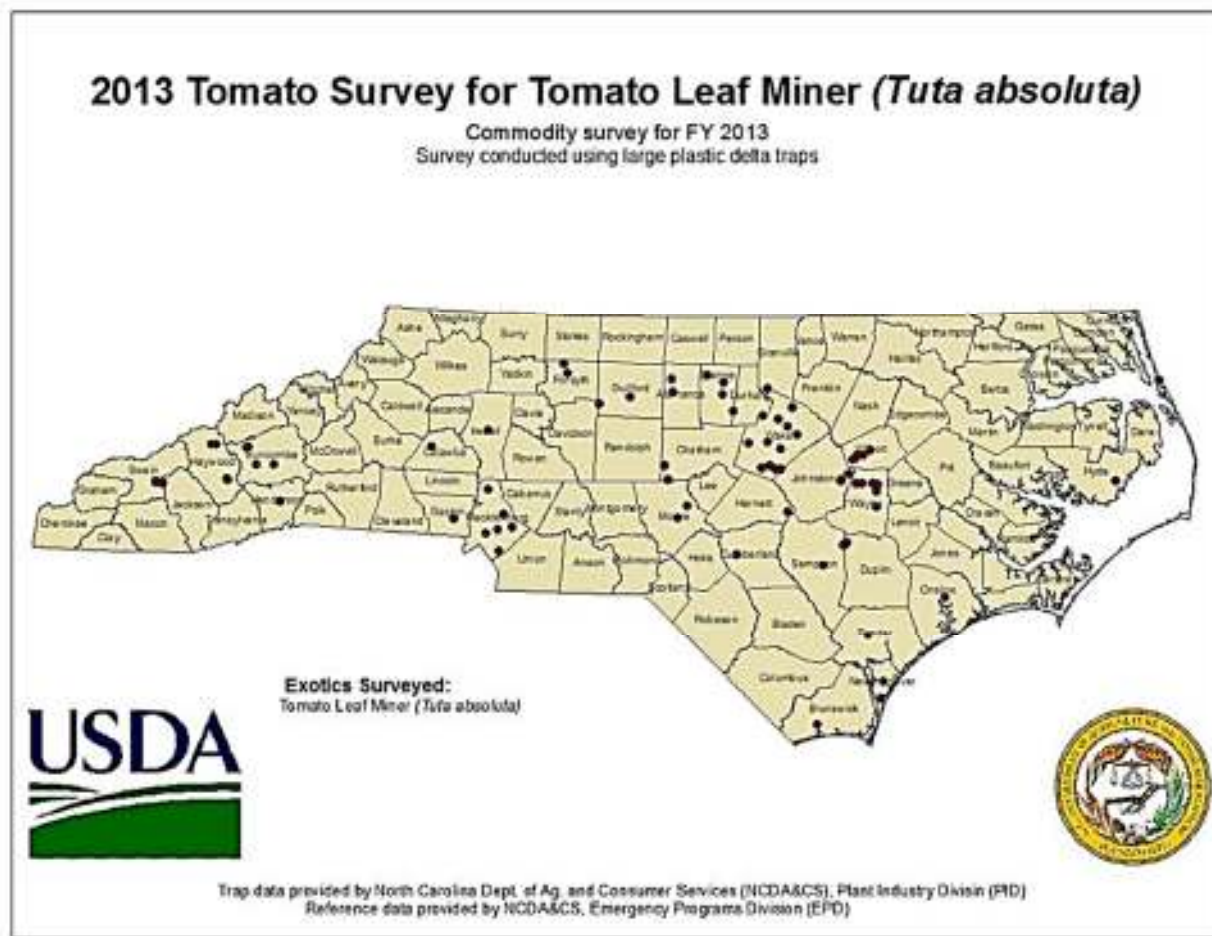


Figure 14 2013 (extended) solanaceous survey locations

Delta traps were used for trapping this pest. In 2013, traps were placed in July and pulled in September. In 2014, traps were placed in home improvement stores in April since this is the approximate time for the last frost free date for much of North Carolina, and pulled again by September. Trapping consisted of 100 sites in 31 counties throughout North Carolina (Figure 14). Samples were collected at the servicing of each trap and screened for the presence of the target pest by the SSC. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

Solanaceous Commodity (2014)

The primary objective of this project was to survey for two exotic solanaceous pests; tomato leaf miner (*Tuta absoluta*) and old world bollworm (*Helicoverpa armigera*). Both are regarded as being highly destructive of solanaceous crops and pose a significant threat to North Carolina agriculture.

Helicoverpa armigera is found in parts of Africa, Asia, Europe, Middle East and Oceania. In early 2013, in the state of Mato Grosso, Brazil, both larvae and moths were collected from infested Bt cotton fields, and were later confirmed through molecular characterization as being *H. armigera*. Old world bollworm was most recently detected in Puerto Rico in September of 2014. This pest is known for quickly developing levels of resistance to commonly used insecticides, including resistance to transgenic crops using Bt. Capable of long distance migration, it may adapt to environmental conditions if it becomes too warm or dry. Economically, it is one of the more costly pests and reports of serious losses are common. Early identification of this pest will limit spread to the natural environment and aid in eradication.

Trapping for this project began in July and ended in October when traps were pulled. Thirty-three sites were spread across 20 counties throughout North Carolina (Figure 15). Samples were collected at the servicing of each trap and screened for the presence of targeted pests. Initial screening was done by the SSC and identification done by PDIC. Twenty-five specimens were visually observed to be a very close match for *H. armigera*. The PDIC determined a species-level identification to be *H. zea*. Because *H. zea* and *H. armigera* look identical, identification of the target required dissection. While our target was not observed, we will continue to look for this pest in future surveys. **No target species were observed or determined to be positive in any of the screened samples for this survey.**

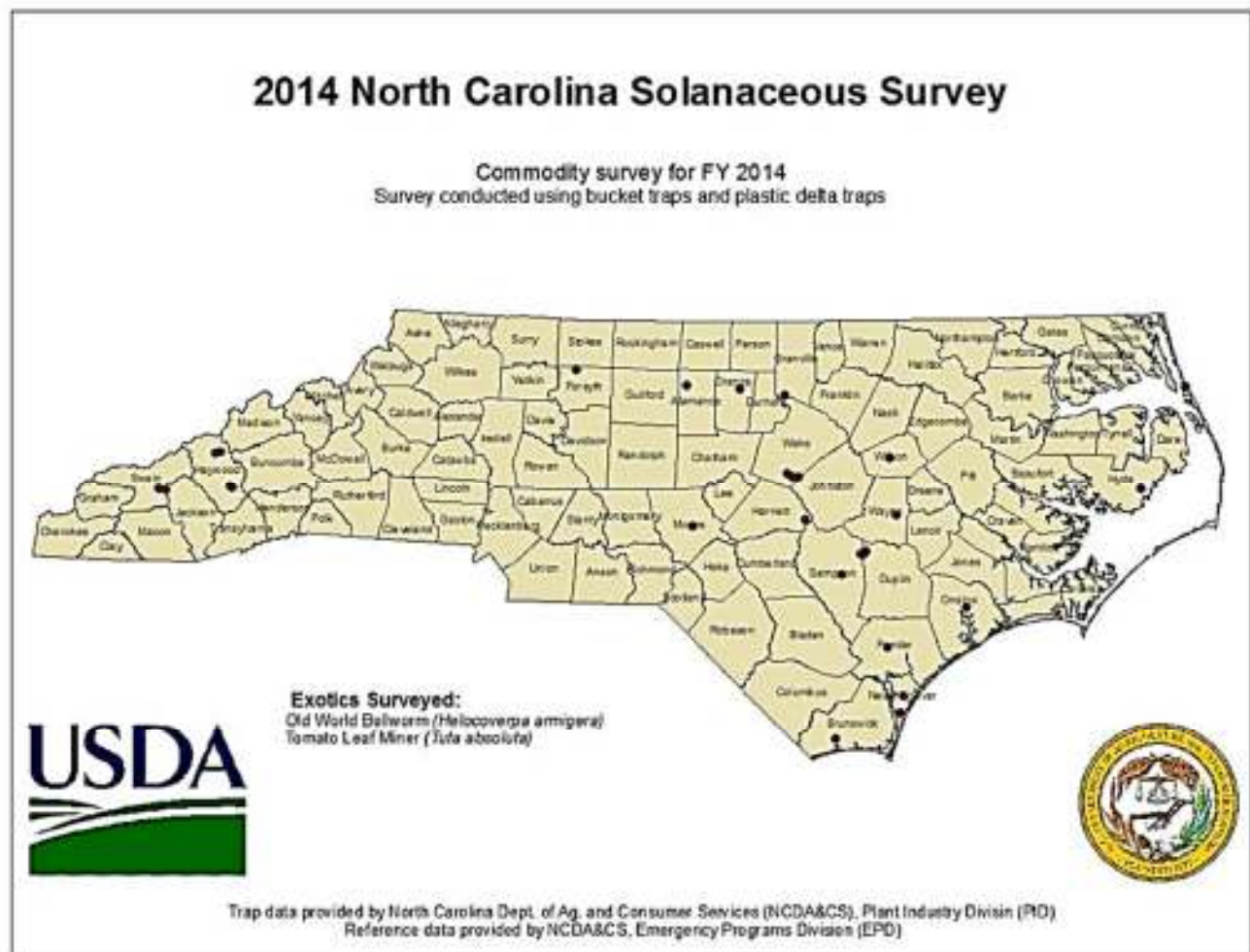


Figure 15 2014 solanaceous survey locations.

Phytophthora

Two phytophthora species were visually surveyed during 2014. Survey for sudden oak death (SOD) and phytophthora leaf blight, (*Phytophthora ramorum* and *P. kernoviae* respectively) were accomplished by visiting nurseries and retail garden centers as well as several wholesale nurseries throughout North Carolina. Specifically, larger metropolitan areas including Charlotte, Greensboro and Raleigh were targeted to account for the movement of larger volumes of hosts and associated plants (HAP). Since both pathogens share common hosts and affect stem and leaf tissue, a survey was developed to include both for improved efficiency.

Visual inspections were conducted at each survey location in May and June. The survey was extended into September and October to include plants arriving at retail locations during the fall season. Primary hosts surveyed for these pathogens were *Rhododendron*, *Viburnum*, *Pieris*, *Kalmia* and *Camellia*. A total of 41 sites covering 14 counties were visited throughout the State (Figure 16). A trace forward event during late August and early September refocused our efforts to survey several additional locations during the fall. “Big box” retailers were primarily targeted during this time.

A total of 103,729 plants were surveyed during the course of this project. Symptomatic host plants were sampled and submitted to the state plant pathologist for testing for the presence of *Phytophthora* using enzyme-linked immunosorbent assay (ELISA). Forty-nine samples were submitted of which three were *Phytophthora* positive. *Phytophthora* positive samples included two *Pieris japonica* and one *Rhododendron catawbiense* 'Album.' All samples that resulted in a positive ELISA test were sent to Kansas State University-Manhattan Diagnostic Laboratory for further diagnostics. All positive phytophthora samples tested negative for our targets. **There were no positive identifications of the target pathogens in any of the samples screened during this survey.**

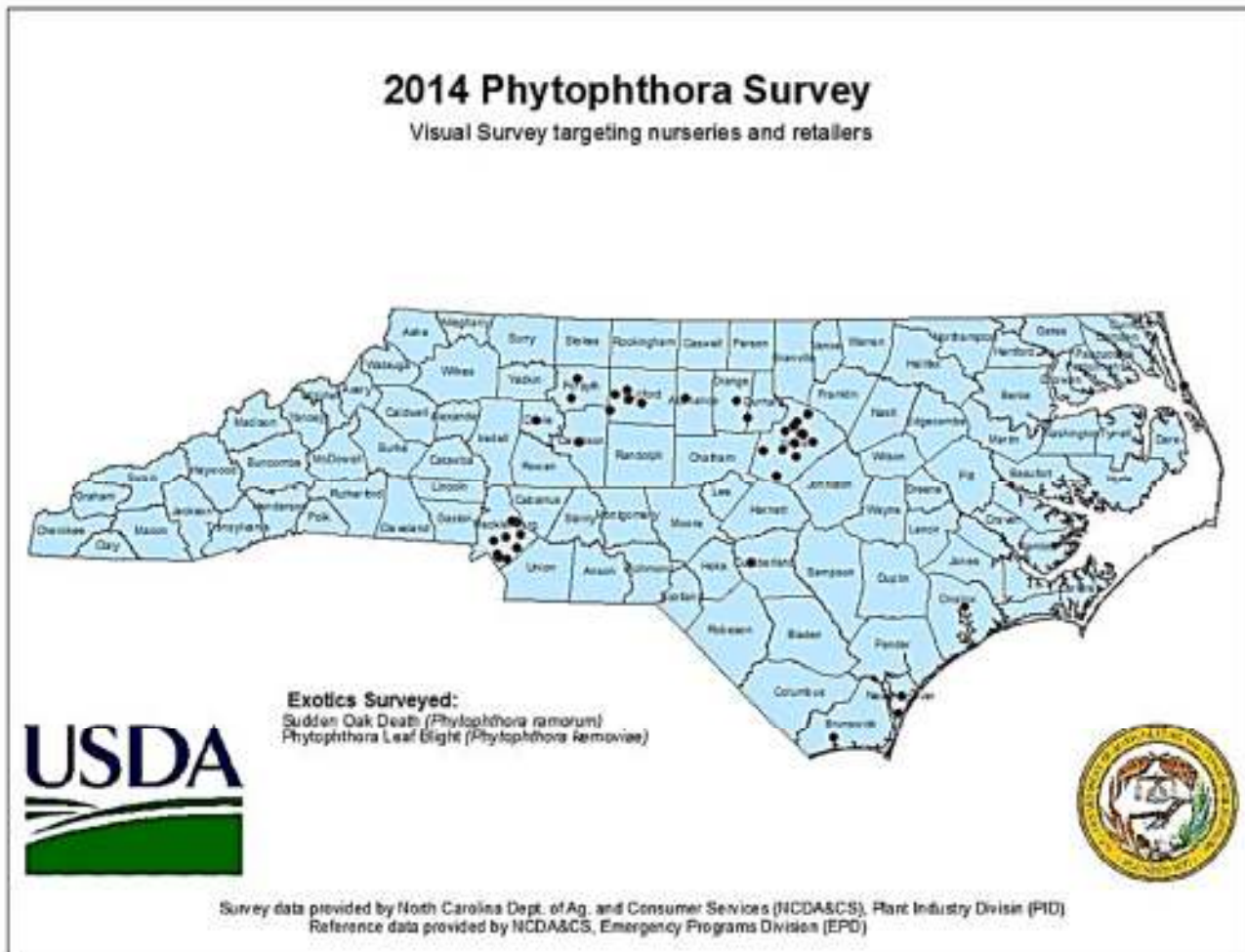


Figure 16 Phytophthora survey locations.

Entomological Programs

Movement of Live Insects for Research, Commercial or Educational Purposes

The NCDA&CS evaluated 89 federal applications, PPQ Permit 526, for the movement of live insects into North Carolina. No permits were rejected in 2014. The large number of applications to move insects to North Carolina reflects the continued market in commercial production, sale, and movement of insects for education, entertainment, and scientific research conducted in North Carolina's academic institutions and the private sector.

Blueberry Export Certification Program

The Canadian Food Inspection Agency requires that all fresh blueberries shipped to Canada come from growers who participate in a Blueberry Certification Program. The program consists of monitoring and control procedures for the blueberry maggot, *Rhagoletis mendax*. Fifty three North Carolina production areas were monitored (5,777 acres total representing 122 fields) throughout the harvesting and shipping period and were issued certification documents. No blueberry maggots were detected in any of the fresh market blueberries being shipped to Canada in 2014.

Boll Weevil Eradication Program

Field surveys for the cotton boll weevil (*Anthonomus grandis*) were coordinated and carried out by the Boll Weevil Eradication Foundation of North Carolina. In 2014, a total of 452,606 acres were reported in 53 North Carolina counties (Table 7). NCDA&CS/Plant Industry surveyed cotton gins (n=36) and cotton processing facilities in 24 counties (Table 8) using conventional cotton boll weevil traps, similar to those used for sweet potato weevil field surveys. Traps were baited with a male specific sex pheromone and checked once a month from October to December 2014.

Table 7 Reported cotton acreage in NC during the 2014 season.

County	Acreage	County	Acreage	County	Acreage
ANSON	3,309.18	GRANVILLE	345.17	PASQUOTANK	2,023.57
BEAUFORT	16,912.72	GREENE	10,292.14	PERQUIMANS	9,485.44
BERTIE	26,313.74	HALIFAX	59,971.38	PITT	15,328.15
BLADEN	6,967.31	HARNETT	10,608.34	RICHMOND	1,322.38
BRUNSWICK	904.80	HERTFORD	11,575.41	ROBESON	11,905.37
CABARRUS	535.57	HOKE	8,517.17	ROWAN	477.41
CAMDEN	427.81	HYDE	9,486.36	RUTHERFORD	137.85
CARTERET	2,367.35	JOHNSTON	5,701.44	SAMPSON	14,169.43
CHOWAN	8,629.81	JONES	9,419.35	SCOTLAND	8,242.63
CLEVELAND	1,373.98	LENOIR	13,188.31	STANLY	11,001.12
COLUMBUS	2,701.76	LINCOLN	98.82	TYRRELL	2,315.15
CRAVEN	6,017.73	MARTIN	29,994.97	UNION	1,725.13
CUMBERLAND	6,477.17	MONTGOMERY	173.34	WAKE	235.91
DAVIDSON	341.44	MOORE	239.07	WARREN	948.17
DUPLIN	7,635.38	NASH	9,618.55	WASHINGTON	10,504.86
EDGECOMBE	19,622.53	NORTHHAMPTON	36,526.44	WAYNE	6,934.17
FRANKLIN	819.74	ONslow	4,179.07	WILSON	10,335.84
GATES	13,927.52	PAMLICO	293.45	TOTAL	452,606.88

Table 8 Cotton gin numbers surveyed for cotton boll weevil in NC

County	Number of gins	County	Number of gins
Beaufort	1	Lenoir	1
Bertie	2	Martin	1
Chowan	1	Nash	1
Cumberland	1	Northampton	5
Duplin	1	Pasquotank	1
Gates	1	Perquimans	1
Greene	1	Pitt	2
Halifax	4	Robeson	2
Edgecombe	1	Sampson	2
Hertford	1	Scotland	1
Hyde	1	Wayne	1
Jones	1	Wilson	2

Emerald Ash Borer Program

Introduction

The emerald ash borer (*Agrilus planipennis*) (EAB) is a serious pest of forest trees affecting primarily trees of the genus *Fraxinus* (ash trees). It was first detected in 2002 in the United States and believed to have been introduced in wood packaging material from China. Since it was first detected, EAB has spread throughout most of the eastern states of the United States. Although their natural spread is limited to an average of 5 miles per year, rapid spread of EAB is attributed to the interstate movement of infested material such as firewood. In the summer of 2013 EAB was discovered in four counties of north-central North Carolina (Person, Granville, Vance, and Warren) along the Virginia border and contiguous with a known infestation in that state, and those counties were quarantined.

As part of the national EAB survey program and in cooperation with USDA-APHIS-PPQ, a survey was conducted in North Carolina in 2014 to determine whether new pockets of EAB infestation exist outside the already established distribution line. This survey was conducted in all but the four EAB-infested counties, as described in this report.

Trapping methodology and results

In April 2014 the North Carolina Department of Agriculture and Consumer Services-Plant Industry Division (NCDA&CS-PID) hired 19 temporary employees to set EAB traps across North Carolina using geo-referenced PDF maps indicating the locations of potential EAB trap sites. Site data for these maps was provided by APHIS-PPQ personnel coordinating the EAB national program and were based on the survey sampling design model developed by APHIS-PPQ and the Forest Health Technology Enterprise Team, also referred to as the FHTET model. When funding was released to NCDA&CS in May, temporaries and permanent personnel began placing traps across the state.

Trap set, check, and pull was done according to the established APHIS-PPQ 2014 survey guidelines. Briefly, purple prism traps baited with a lure consisting of a mix of manuka oil and (Z)-3 Hexanol were placed exclusively in ash trees at a minimum height of 15 feet. Traps were checked and the lure changed after 6-8 weeks and then after another 6-8 weeks the traps were completely pulled and inspected for EAB presence at the end of the survey season. Trap set calendars were established based on the 450 degree day line for the state of North Carolina. Trap locations were recorded using GPS units.

Personnel from the NCDA-Forest Service (NCDA-FS) were contracted to set traps in five counties in central North Carolina. Training and materials for NCDA-FS personnel were provided through NCDA&CS-PID, so all procedures conformed to USDA-APHIS-PPQ protocol. All NCDA-FS data is incorporated into this report.

For the 2014 EAB survey season, 554 traps were set in 60 counties across North Carolina (Table 9 and Figure 17). Trap pull was completed in August. No new EAB was found as a result of trapping in 2014.

Table 9 2014 distribution of EAB trap locations by county in North Carolina.

County	Traps Set	County	Traps Set	County	Traps Set
Alamance	15	Edgecombe	4	Northampton	5
Alexander	4	Franklin	3	Orange	17
Alleghany	5	Gaston	11	Polk	2
Anson	3	Graham	6	Randolph	22
Ashe	6	Guilford	16	Rockingham	9
Avery	10	Halifax	3	Rowan	19
Bertie	1	Haywood	15	Rutherford	11
Buncombe	22	Henderson	8	Stanly	14
Burke	8	Iredell	9	Stokes	12
Cabarrus	15	Jackson	9	Surry	8
Caldwell	11	Johnston	1	Swain	5
Caswell	8	Lee	1	Transylvania	2
Catawba	11	Lincoln	8	Union	22
Chatham	9	Macon	13	Wake	12
Cherokee	14	Madison	15	Watauga	10
Clay	3	McDowell	10	Wayne	1
Cleveland	3	Mecklenburg	31	Wilkes	5
Cumberland	1	Mitchell	5	Wilson	3
Davidson	21	Montgomery	5	Yadkin	4
Durham	14	Nash	4	Yancey	10
				Total	554

Additional discretionary traps were placed by two other entities. USDA-Forest Service placed 14 purple prism traps in Pisgah Forest at sites deemed to be at high risk of introduction, such as campgrounds. Duke Forest also placed 4 purple prism traps within the boundaries of their property. Data for these trap locations is incorporated into Table 9.

Visual surveys

At the beginning of the trapping season, temporary employees were trained in inspecting for signs of EAB infestation in ash trees (such as decline, woodpecker damage, splitting bark, epicormic shoots).

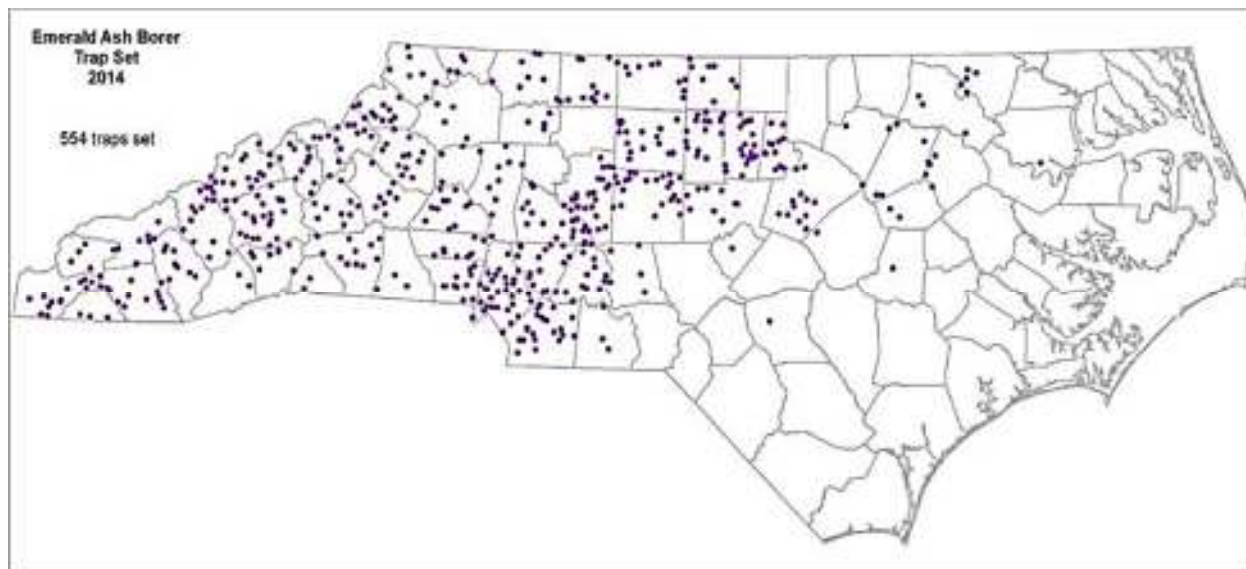


Figure 17 Emerald ash borer traps set in North Carolina for the 2014 survey season.

Using data provided by the Forest Health Technology Enterprise Team (FHTET), our GIS specialist created maps indicating the likelihood of finding ash trees (Figure 18). Temporaries used these “weather radar” style maps to record where they found ash trees, the condition of the tree (healthy or declining), and if declining, whether the trees had signs of EAB infestation. No trees were found to be positive for EAB using this inspection method at 1639 sites, but valuable data on ash tree locations across North Carolina was gathered and will be used to assist in expediting trap placement in 2015 (Figure 19). NCDA&CS temporary employees drove a total of 45,041 miles, a combined total reflecting both trapping and visual surveys.



Figure 18 Example of “weather radar”-style ash scouting map used for visual surveys. Likelihood of finding ash trees is indicated by coloration, using data derived from the Forest Health Technology Enterprise Team (FHTET).

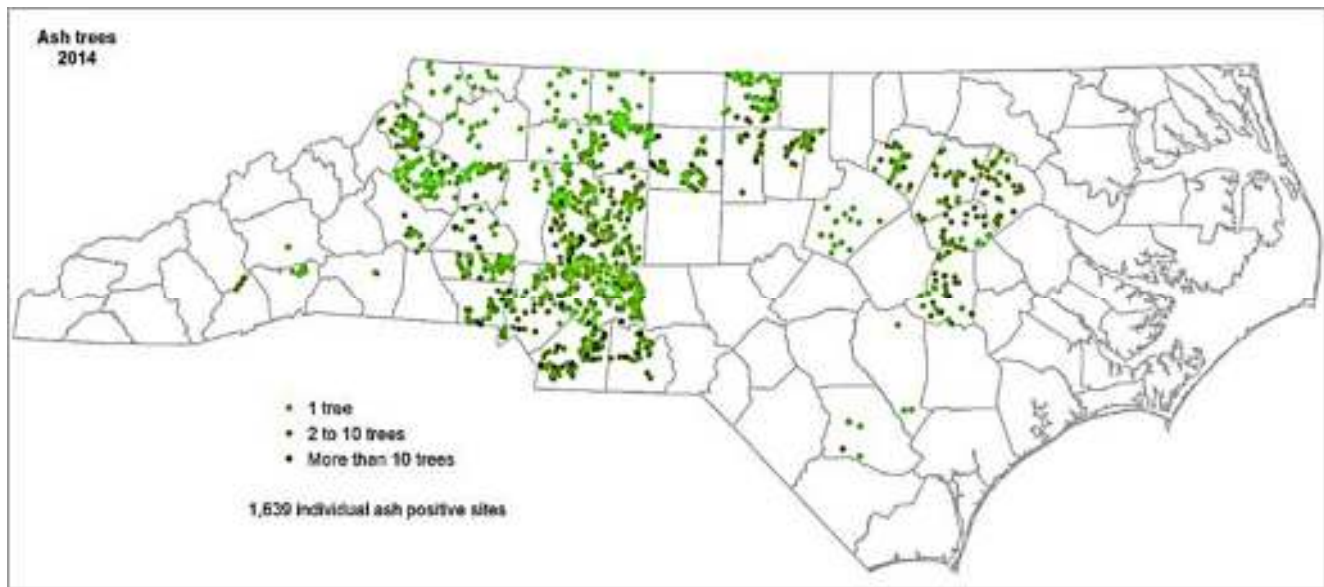


Figure 19 Locations of positive ash trees sites identified in 2014 scouting efforts (Dots indicate the location and density of *Fraxinus* spp identified.)

Imported Fire Ant Survey and Monitoring Program

Introduction

The Imported Fire Ant (*Solenopsis invicta*) (IFA) continues to be a serious pest in the southern United States with infestations occurring in eleven states. North Carolina is on the leading edge of the expanding range of fire ants. Currently, 71 of North Carolina's 100 counties are either partially or entirely infested. NCDA&CS' objective is to prevent the artificial spread of IFA from infested areas to non-infested areas through regulatory actions.

Methodology and Results

Drive-by surveys (visual inspections) were conducted from March to August 2014 in 31 counties along the current IFA quarantined line (Table 10). The results of these surveys are shown in Figure 20. As a result of these surveys, and the 2013 surveys, new areas were added to the IFA quarantine line including Catawba County the area south of I-40 and the entire Lincoln County (Figure 20). To reinforce federal regulations, IFA blitzes were conducted at the weigh stations in Halifax (I-95 corridor in Halifax County), Mount Airy (I-77 Corridor in Surry County) and Hendersonville weigh station (I-26 Corridor in Henderson County) respectively. Drivers were asked about IFA regulated articles and soil samples were collected from regulated articles, processed and sent for chemical analyses (NCDA&CS Food and Drug Protection Division Laboratory) to determine the levels of bifenthrin or any other approved pesticides as required by the federal and state regulations.

Table 10 Results of 2014 IFA surveys in NC.

County	Miles	Acres	New Sites	Mounds	Contacts
Alamance	347	69	27	132	10
Alexander	328	28	1	1	7
Buncombe	614	73	9	10	24
Burke	930	117	11	47	32
Caldwell	528	43	2	2	28
Caswell	25	9	0	0	0
Catawba	695	89	16	86	21
Davidson	439	56	6	18	10
Davie	239	29	1	1	6
Forsyth	417	87	5	46	8
Graham	364	106	8	44	44
Granville	323	19	0	0	6
Guilford	397	67	8	35	3
Halifax	1126	115	33	257	22
Haywood	631	171	0	0	57
Henderson	451	186	3	29	60
Iredell	370	51	10	37	5
Jackson	1089	282	13	60	84
Macon	788	279	25	311	78
McDowell	741	65	8	37	24
Northampton(*)	1281	85	11	144	49
Orange	716	58	19	60	19
Person	141	11	0	0	4
Rockingham	47	6	0	0	2
Rowan	214	35	4	23	1
Rutherford	619	60	13	79	17
Swain	367	128	18	36	37
Transylvania	456	136	5	8	42
Vance	299	20	0	0	8
Warren	681	33	11	23	11
Wilkes	153	16	0	0	5
Grand Total	15816	2529	267	1526	724

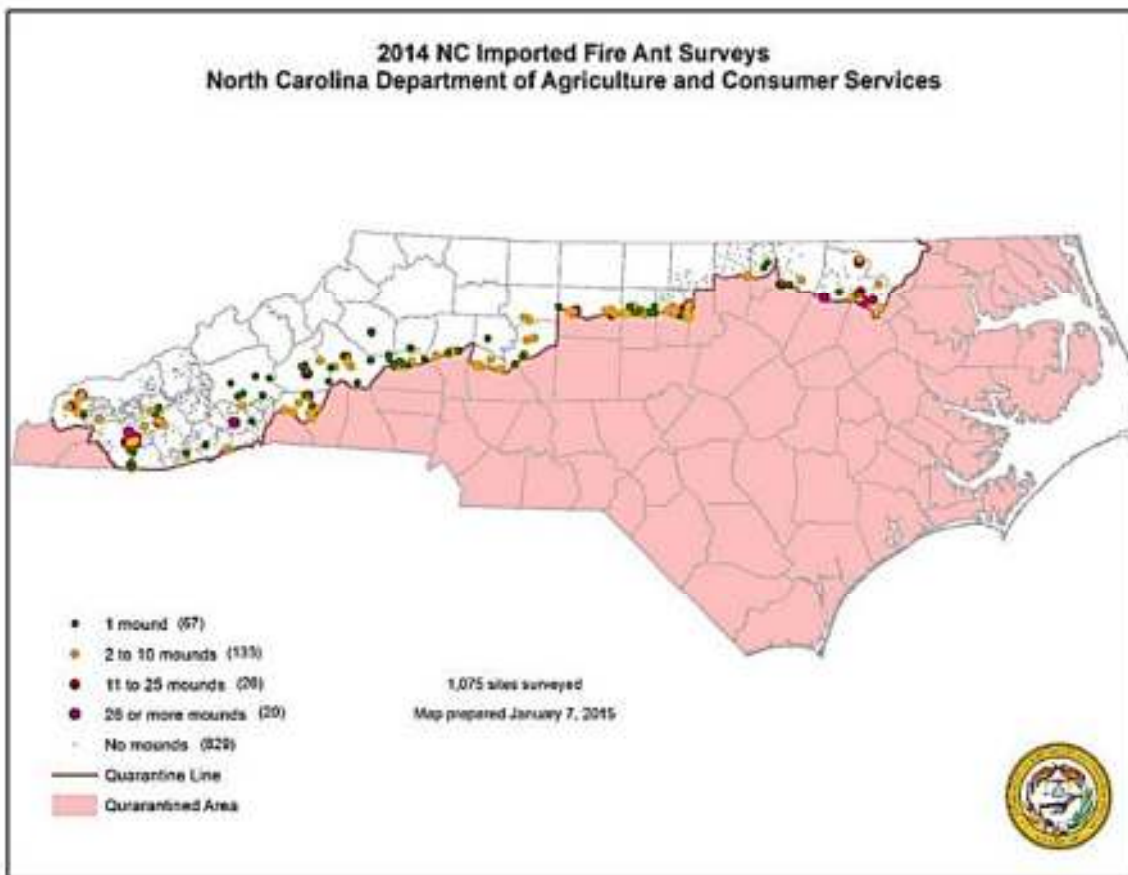


Figure 20 New IFA mounds frequency along the quarantined line in North Carolina.

European Gypsy Moth Program

In 2014 NCDA&CS, in cooperation with USDA-APHIS-PPQ and the Slow the Spread (STS) Foundation, carried out an extensive trapping, treatment, regulatory, and alternate life stage survey program aimed at detection and eradication of European gypsy moth (EGM), a major invasive pest of hardwood trees. The program in North Carolina is divided into two different areas, STS and Eradication, as shown in Figure 21.

Trapping

Counties to be trapped in 2014 was determined using the NCDA&CS Master Survey Plan (Figure 22). Some adjustments were made according to known increases in risk of spread or potential population establishment.

A total of 13,631 traps were set in 97 counties in North Carolina from April to June 2014 and removed from July to September 2014. Traps were baited with Disparlure, the female-produced sex pheromone of gypsy moth (2-methyl-7R, 8S-epoxy-octadecane). Trap locations and data were recorded in iPad units. 757 adult gypsy moth males were captured in 348 positive traps in North Carolina in 2014. Positive catches were confirmed by the state entomologist and entered into the gypsy moth trapping database at Virginia Tech. Final results of these surveys are shown in Figure 23 and Table 11.

Per 2014 USDA-APHIS-PPQ protocol as stipulated in the cooperative agreement (14-8237-0864-CA), trapping surveys were conducted in the Eradication area as shown in (Figure 21). Delta traps were set in an area-wide grid of 1 trap per 3 kilometers, with some areas being trapped at one trap per 500 meters if there was a suspected EGM population. Funding provided by USDA-APHIS-PPQ and the state of

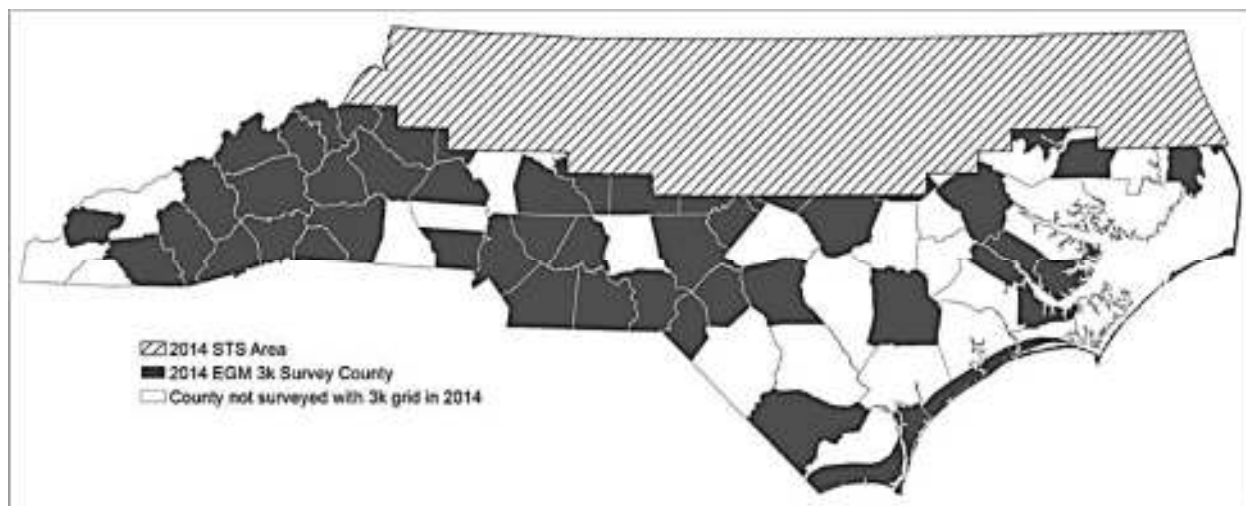


Figure 21 Gypsy moth Slow the Spread (hatched) and eradication survey areas. Shaded counties indicate areas in which EGM 3k grid surveys were conducted.

North Carolina was used to employ 12 temporary employees, buy the necessary survey supplies (including traps, lures, iPads, and office supplies), and for operational expenses (including fuel and maintenance for survey vehicles). Temporary employees drove a total of 57,718 miles while conducting this program.

Master Survey Plan, NCDA&CS APHIS Gypsy Moth Program

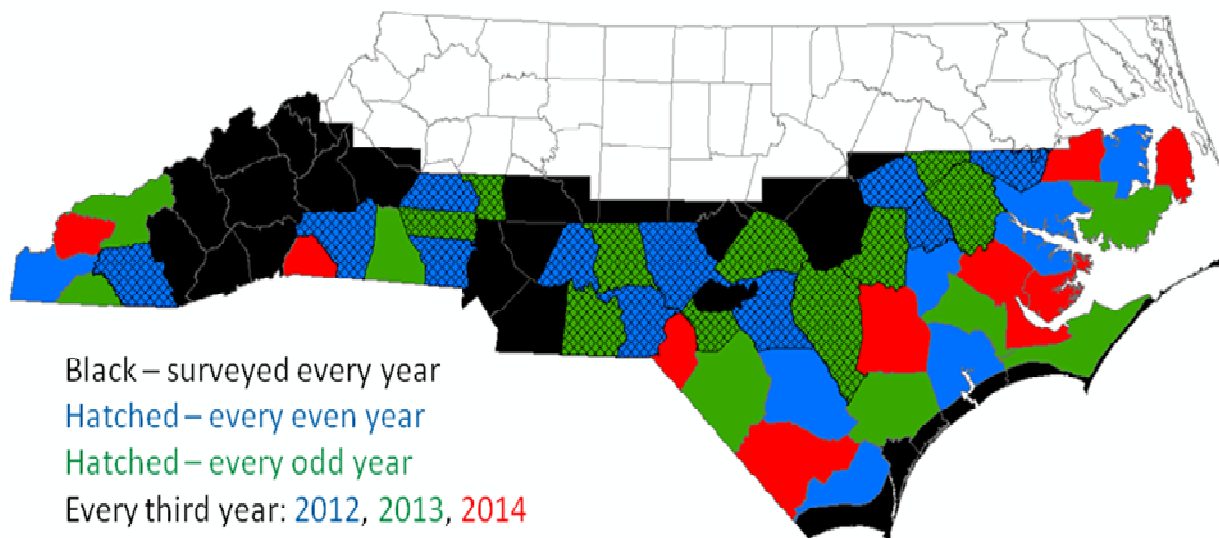


Figure 22 NCDA&CS gypsy moth master survey plan

2013 Gypsy Moth Survey Data

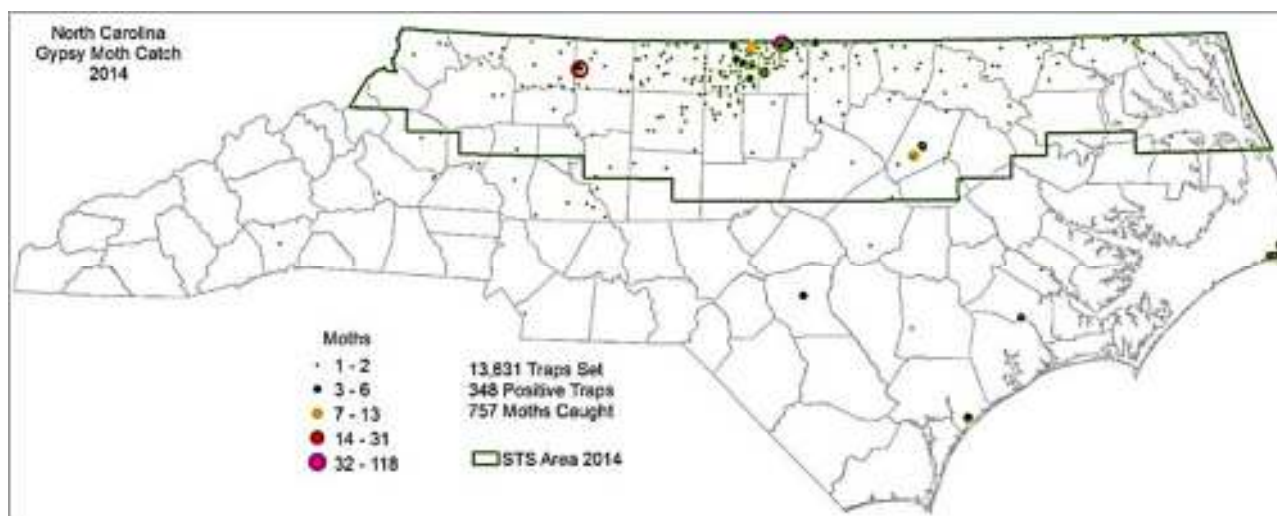


Figure 23 North Carolina gypsy moth trap catches in 2014.

In the STS area, 10 contractors set traps in 23 bid units, according to site data provided by the STS Foundation in cooperation with Virginia Tech. Delta traps were set in an overall grid of 1 trap per 2 kilometers along the northern portion of the STS area; all other portions of the STS area were trapped at a density of 1 trap per 3 kilometers. Locations with high catches the previous year or areas under evaluation from treatments in previous years were surveyed in a 500-meter grid utilizing high-density milk carton traps.

A number of traps were set at three high-probability gypsy moth catch locations across the state and monitored weekly to observe male moth flight timing. Results, shown in Figure 24, indicate which week male moths emerged and when peak emergence occurred. Male moth catch generally took place over a three week period, and a little later than was expected.

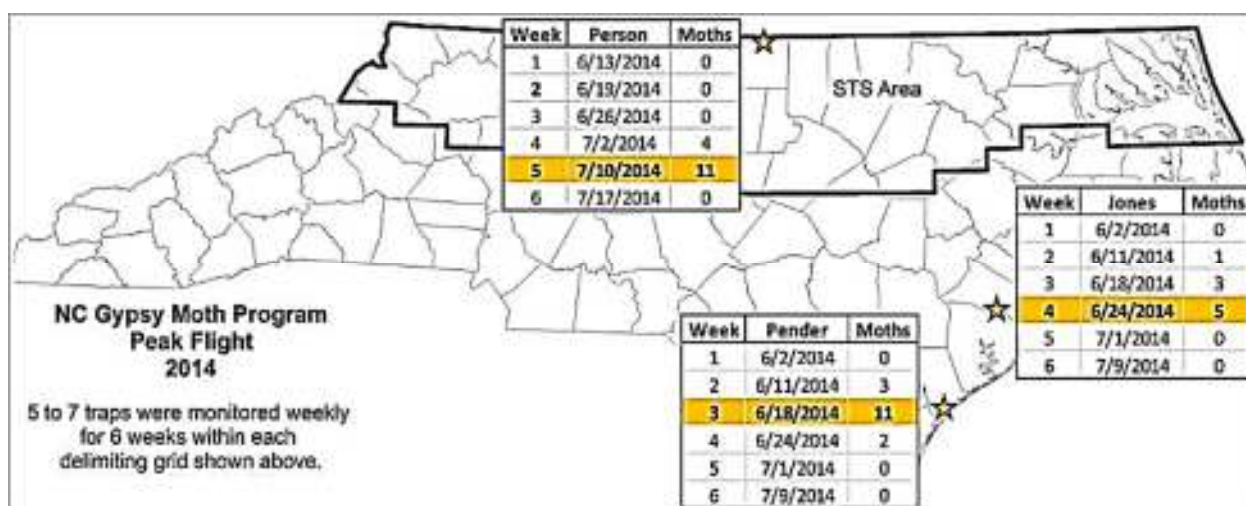


Figure 24 Sites monitored weekly to determine exact week of peak male gypsy moth flight.

Table 11 2014 European gypsy moth survey results by county.

County	Total Traps	Total Traps Positive	Total Catch
Alamance	166	13	15
Alexander	72	1	1
Alleghany	156	4	4
Anson	141		
Ashe	167	3	3
Avery	58	1	1
Beaufort	2		
Bertie	300		
Bladen	6		
Brunswick	91		
Buncombe	157		
Burke	147	4	6
Cabarrus	113		
Caldwell	121	2	2
Camden	158	6	7
Carteret	37		
Caswell	374	61	92
Catawba	122	1	1
Chatham	227		
Cherokee	10		
Chowan	87	1	1
Clay	1		
Cleveland	3		
Columbus	198		
Craven	185	1	1
Cumberland	170	1	6
Currituck	281	3	3
Dare	148	14	38
Davidson	164	4	4
Davie	57	1	1
Duplin	211	1	1
Durham	151		
Edgecombe	141	1	1
Forsyth	140	3	3
Franklin	284	2	2
Gaston	97		
Gates	242	10	10

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Graham	45		
Granville	388	15	17
Guilford	202	11	14
Halifax	447	6	6
Harnett	2		
Haywood	108		
Henderson	91	1	1
Hertford	227	4	5
Hoke	71		
Hyde	15		
Iredell	66	3	3
Jackson	105		
Johnston	220	2	2
Jones	23	4	9
Lee	74		
Macon	93		
Madison	103		
Martin	43		
McDowell	119		
Mecklenburg	168		
Mitchell	58		
Montgomery	1		
Moore	200		
Nash	212	11	31
New Hanover	63		
Northampton	360	10	11
Onslow	40	1	1
Orange	218	2	2
Pamlico	78		
Pasquotank	154	4	5
Pender	47	2	16
Perquimans	153		
Person	268	53	224
Pitt	190		
Polk	55		
Randolph	220	2	2
Richmond	131		
Robeson	5		
Rockingham	418	32	34
Rowan	147	6	7

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Rutherford	155		
Sampson	4		
Scotland	84		
Stanly	117		
Stokes	334	12	134
Surry	344	7	7
Swain	4		
Transylvania	58		
Tyrrell	40	2	2
Union	170	1	1
Vance	188	4	4
Wake	263	2	2
Warren	338	6	6
Washington	98		
Watauga	100		
Wayne	6		
Wilkes	240	3	4
Wilson	111	1	1
Yadkin	114	3	3
Yancey	50		
Total	13631	348	757

Treatments

Three mating disruption treatments were conducted in North Carolina in 2014, all under the guidance of the USDA-Forest Service in the Slow the Spread area (Figure 25 and Table 12). Each site received one dose of Disrupt II pheromone flakes at a rate of 6 grams per acre. These sites will be trapped to determine the efficacy of the treatments in 2015.

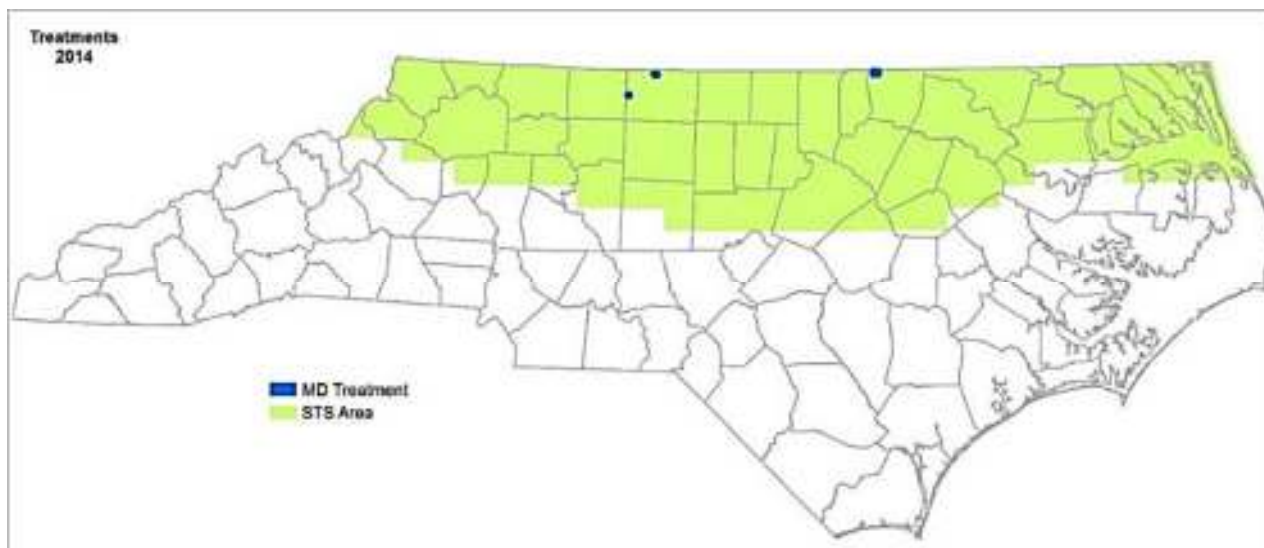


Figure 25 Gypsy moth treatment sites.

Table 12 Gypsy moth treatment site locations and acreage.

Site name	County	Acres
Bracey	Warren	1804
Ayersville	Rockingham	174
Northwest Eden	Rockingham	517

2014 Gypsy Moth Regulatory Program

The gypsy moth program also seeks to mitigate the risk of introduction through a comprehensive regulatory program. An area that is generally infested is quarantined such that the movement of certain high-risk articles is strategically restricted and regulated. In North Carolina, Currituck and a small portion of Dare Counties were quarantined in 1988. A map of the North Carolina gypsy moth quarantine area is shown in Figure 26.

Regulated articles may be moved from quarantined to non-quarantined areas if the appropriate personnel undergo training and submit to the stipulations of a compliance agreement with NCDA&CS. These compliance agreements require inspection and/or treatment of articles to ensure that they are free of gypsy moth life stages. A number of businesses and individuals



Figure 26 NC Gypsy Moth Quarantine

received training for new staff and several new compliance agreements were issued.

Public education efforts are also an important part of the regulatory program. Staff visits North Carolina Cooperative Extension and North Carolina Forest Service offices to update county personnel on program changes. Also, program personnel monitor all high-risk locations in the STS program area by the placement and removal of traps.

The regulatory program is enduring a time of transition as USDA-APHIS-PPQ, the federal granting agency, has steadily decreased gypsy moth regulatory grants. NCDA&CS' dedicated regulatory position no longer exists, though the person who previously held that post has assumed different responsibilities on our staff and remains able to assist with gypsy moth regulatory tasks. The future character of the program will be determined in part by USDA-APHIS-PPQ funding for this program.

Alternate Life Stage Surveys

Alternate life stage surveys were conducted in 3 locations, all within the GM-STS area. A survey was conducted in Person County near Hurdle Mills, but no alternate life stages were found. Another survey was conducted in Person County near the Virginia state line off Woodsdale Road, and two spent egg masses were found. A third survey was conducted in Stokes County near the town of Pinnacle, where 11 viable egg masses, 21 spent egg masses, and 3 pupal cases were found. Due to the high male moth capture during the summer, all three locations were proposed to be treated with mating disruption in 2015.

During the successful survey of the Stokes County location, evidence of logging was noted in close proximity to viable egg masses, as seen in Figure 27, indicating the possibility of viable egg masses being relocated away from the site on logs. Ginger Hemmings, Plant Pest Specialist for Stokes County, tracked down persons responsible for the logging on the 10-acre tract. It was determined that the logs had been debarked, with the bark being ground twice and then composted prior to egg hatch time, eliminating threat of spread. The tops of the trees, however, had been taken for firewood by at least a couple of different nearby residents, and subsequently sold outside the area with no record of where or to whom. However, NCDA&CS personnel were able to inspect a substantial portion of this firewood, as seen in Figure 28, and determined that no egg masses were present. Literature and instructions on how to identify gypsy moth egg masses were given to loggers and they were asked to inspect all tree portions leaving the infested site prior to movement.



Figure 27 Gypsy moth egg mass on flagged tree in Stokes County. Note evidence of recent logging in the background.



Figure 28 Stacks of firewood removed from positive gypsy moth site in Stokes County. Firewood was inspected and cleared for sale.

Sweet Potato Weevil Trapping Program.

NCDA&CS personnel continue the statewide comprehensive sweet potato weevil trapping survey on all commercially grown sweet potato fields. Traps containing the female sweet potato weevil pheromone are placed at a density of one trap per ten acres with a minimum of two traps per field. In 2014, a total of 10,992 traps were set on 72,000 acres (Figure 29; Table 13). Trap set was done following the established guidelines and protocols developed by the Southern Plant Board in 1995. Briefly, two traps were placed for the first 10 acres and 1 additional trap for each additional 10 acres with a minimum of 2 traps per field. Conventional green boll weevil traps were used for sweet potato weevil surveys in production fields (Figure 30) because of their low cost. Custom made GeoPdf maps were used in mobile devices (iPad minis) to navigate and locate sweet potato fields and to collect data including time and date of trap set, field type (reported, unreported and absent) and coordinates (latitude and longitude) for each trap set. Traps were left in the field for a period of three weeks and subsequently pulled. Data collected during the trap pull process include the trap condition (lost, damage, good) and the number of weevils found. **No weevils were found in field surveys during the 2014 trapping season.**

NC Sweet Potato Production Areas

2014 Reported Sweet Potato Acreage

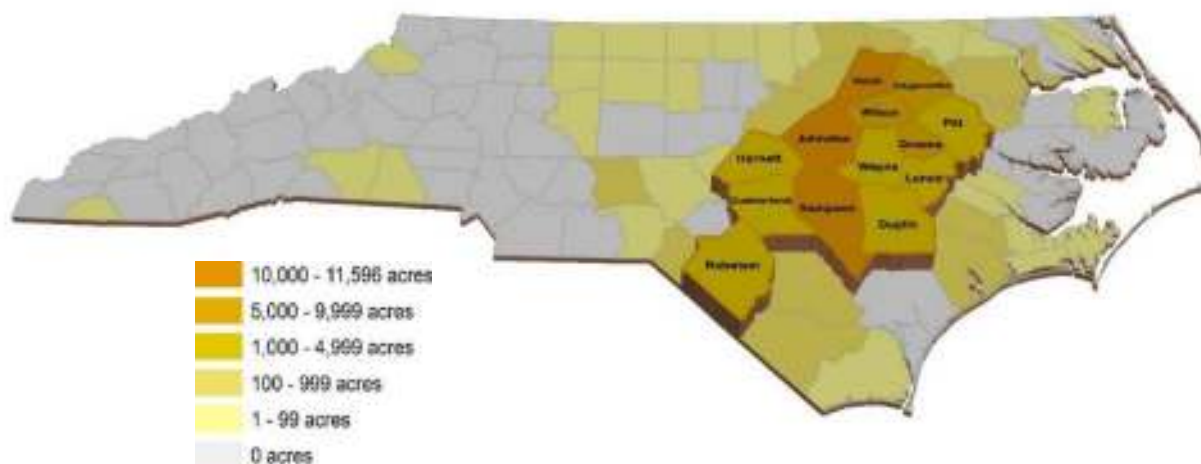


Figure 29 Sweet potato production areas in NC.

Storage facilities surveys

Sweet potato storage facilities, processing plants, micropropagation units and greenhouse operations growing ornamental sweet potatoes were surveyed all year long. Because of the higher trapping efficiency, Universal Moth Traps (UMT) or bucket traps were used instead of the conventional green boll weevil traps used in the field (Figure 30). For these operations, a minimum of two (one inside and one outside) and a maximum of four traps were set per operation. Traps were placed in major strategic locations where sweet potatoes are stored and/or in and around the locations outside the buildings where sweet potatoes are loaded or unloaded. Lures were changed in each trap once a month and data

collection was done using the same procedure detailed for the field surveys. A total of 75 storage facilities were surveyed in 17 counties. **No weevils were found in storage facilities during the 2014 season.**

Table 13 Number of sweet potato weevil traps set in North Carolina counties in 2014.

County	Traps set	County	Traps set	County	Traps set
Sampson	1851	Bladen	110	Brunswick	7
Johnston	1776	Wake	106	Carteret	6
Nash	1648	Scotland	78	Lee	6
Wilson	1008	Warren	64	Caswell	4
Edgecombe	823	Chowan	50	Rockingham	4
Wayne	664	Bertie	46	Granville	3
Greene	550	Onslow	43	Tyrrell	3
Cumberland	439	Franklin	39	Camden	2
Harnett	412	Jones	36	Craven	2
Duplin	237	Martin	29	Guilford	2
Pitt	231	Moore	24	Hertford	2
Columbus	192	Stokes	18	Northampton	2
Lenoir	189	Montgomery	9	Person	2
Robeson	138	Pasquotank	8	Vance	2
Halifax	119	Richmond	8	Total	10992

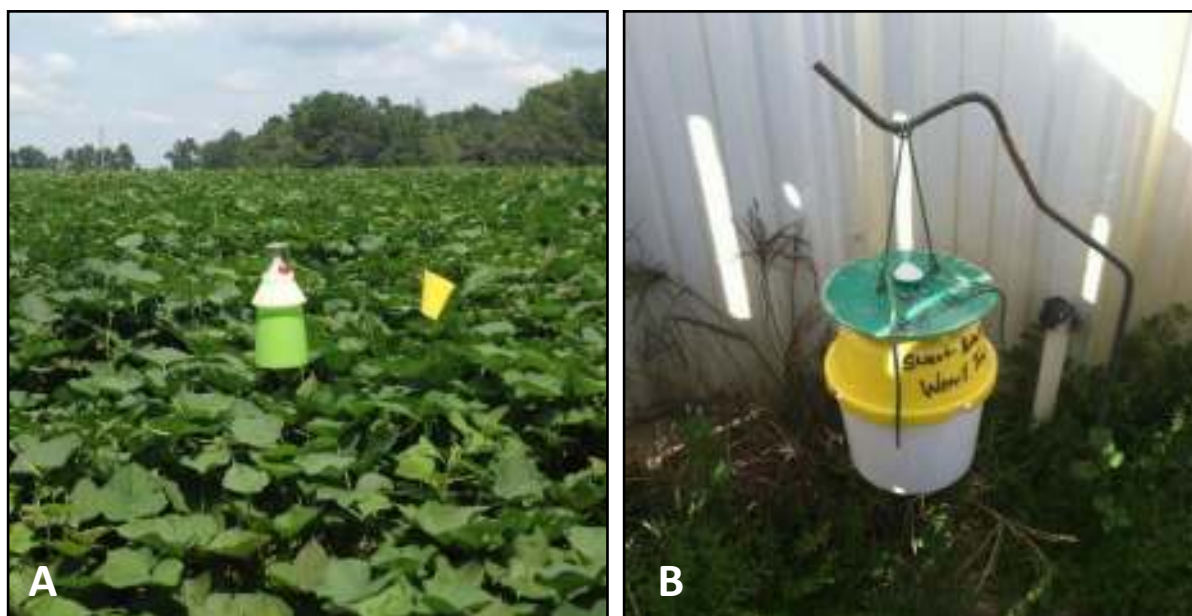


Figure 30 Sweet potato weevil traps

(A) Green boll weevil trap used to survey sweet potato fields and, (B) Universal Moth Trap used to survey storage facilities.

Quarantined area surveys

Surveys for SPW are conducted in the quarantined areas in New Hanover and Brunswick counties from July to December. Around 100 traps were set along two transects in Carolina and Caswell beach to monitor weevil populations. Lures were changed every month and data on weevil numbers and positive trap location was recorded. Sweet potato weevils are still detected in the area with peak numbers in August and September.

Walnut Twig Beetle Program (Thousands Cankers Disease of walnuts)

Introduction.

Thousand cankers disease (TCD) is a serious disease of forest trees affecting primarily black walnuts (*Juglans nigra*) and butternuts (*Juglans cinerea*). The disease is caused by a fungus (*Geosmithia morbida*) which is spread by the walnut twig beetle. TCD is characterized by a large number of “cankers” (dead tissues) on branches and stems causing dieback and, in severe cases, tree mortality. TCD is spreading rapidly through the Eastern United States and has been reported in Virginia and Tennessee and more recently in Haywood County in North Carolina. As a result of TCD presence in Haywood County, the entire county was quarantined and the movement of firewood and other regulated commodities restricted in that area since January 2013. The NCDA&CS has been conducting TCD surveys along these border areas in North Carolina since 2011. The following information is a summary of our 2014 survey results.

Methodology and results.

Walnut Twig Beetle (WTB), *Pityophthorus juglandis*, surveys were conducted near the North Carolina/Virginia border and in eastern North Carolina from July 1 to October 15, 2014. An intensive visual survey was conducted two months previous to the target trap set date (July 1) to identify declining walnut trees where the traps were to be set. Traps were set following the 2014 APHIS PPQ guidelines for WTB. Briefly, 78 Lindgren funnel traps baited with a male-produced aggregation pheromone (Contech Enterprises, Inc.) were set in 30 counties. Traps were set by declining walnut trees in urban and rural areas from July 1 to July 10, 2014 (Figure 31; Figure 32; Table 14).

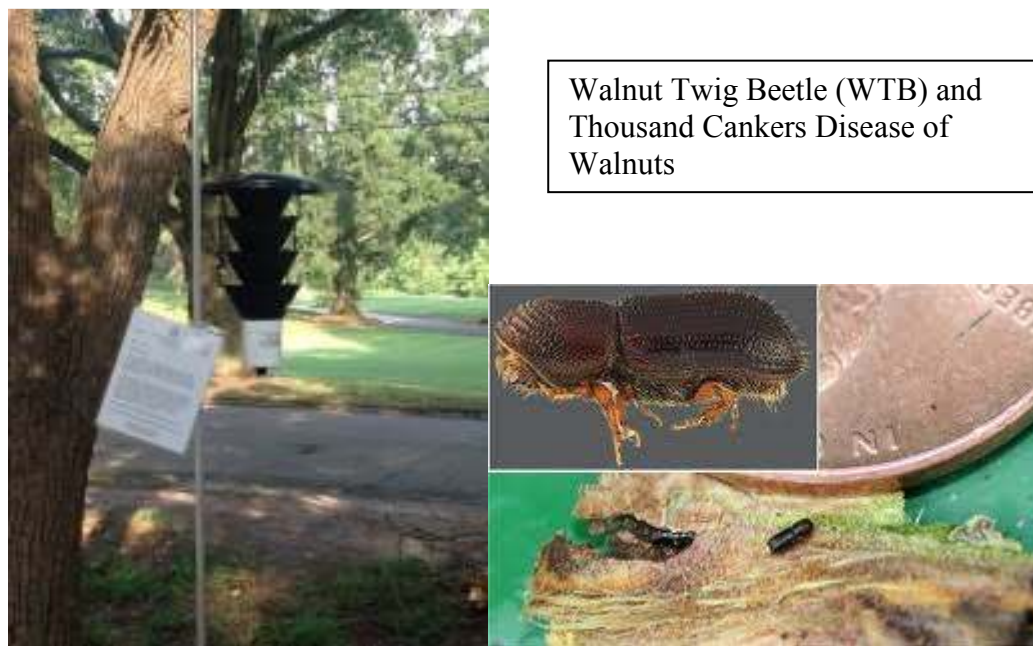


Figure 31 Walnut twig beetle trap.

Typical Lindgren funnel trap (four funnels) set on a pole by a walnut tree. WTB traps are baited with a pheromone and used to survey for WTB (right).

The location of each trap (GPS coordinates) was recorded with GPS units. Collection cups in traps were filled with marine-type antifreeze to one inch from the bottom of the cup. Every two weeks until the end of the survey season, the content of the collection cup was filtered (paint filters) and the antifreeze

content changed. Filtered content was screened for WTB by the NCDA&CS entomologist. Lures were purchased from Contech Enterprises, Inc. and were set up following the protocols established by the USDA-APHIS 2014 surveys guidelines for TCD. Lures were replaced every month in each trap. Personnel from the NCDA&CS Plant Industry and Forest Service division participated in these surveys. Additionally, brochure and informational material was prepared and distributed to the residents in the areas surveyed when necessary. **No adult walnut twig beetle was detected in these surveys.**

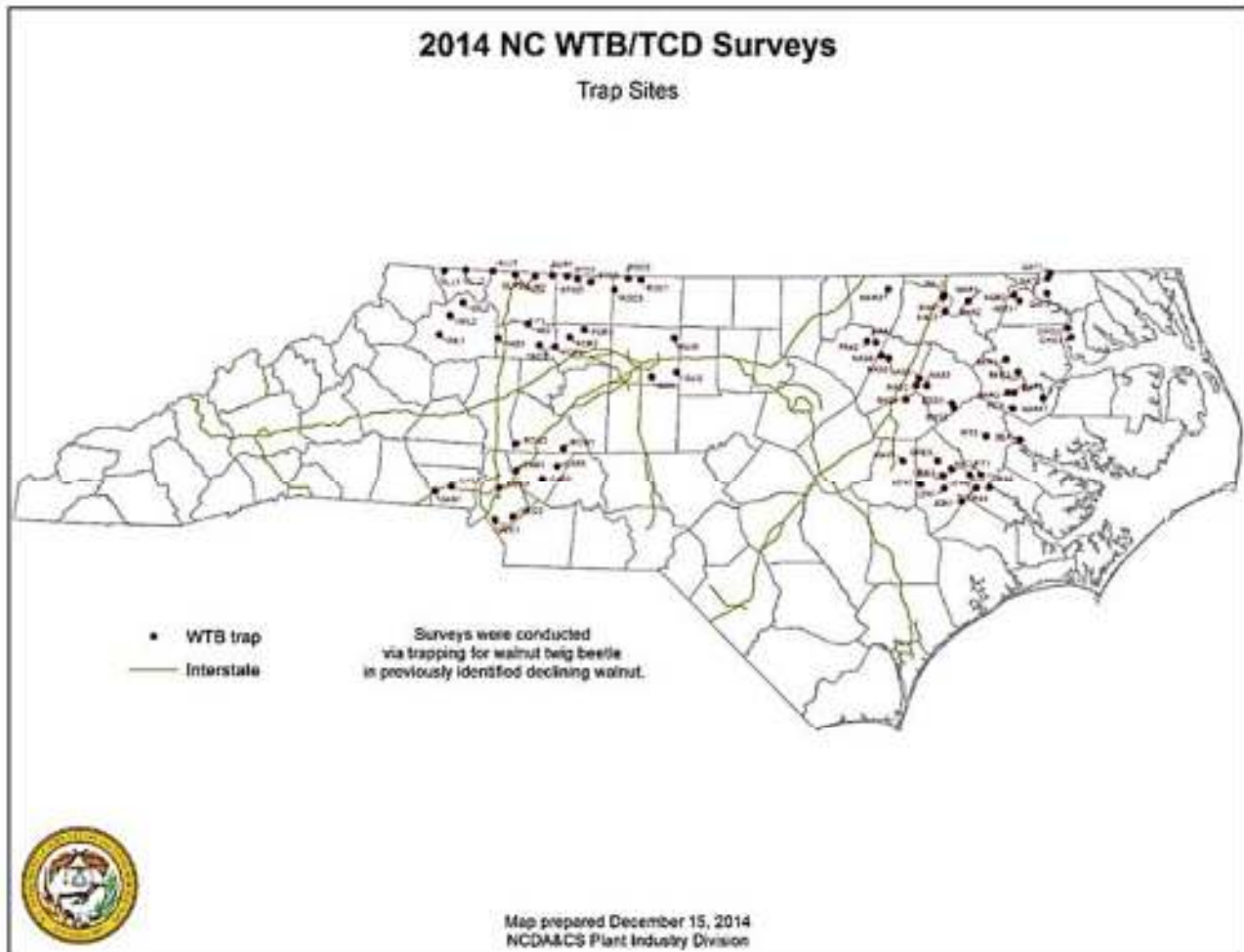


Figure 32 Site location for walnut twig beetle surveys in NC.

Table 14 Coordinates of TCD traps in NC for the 2014 WTB surveys.

Year	Site ID	Site type	County	Latitude	Longitude
2014	NCTCD2014-ALL2	Residential	Alleghany	36.5617100	-81.1054741
2014	NCTCD2014-ALL3	Residential	Alleghany	36.5574466	-80.9084109
2014	NCTCD2014-ALL1	Residential	Alleghany	36.5551825	-81.2651020
2014	NCTCD2014-BEA	Residential	Beaufort	35.5724746	-77.0662690
2014	NCTCD2014-BER1	Residential	Bertie	36.0439190	-77.1598520
2014	NCTCD2014-BER3	Residential	Bertie	35.9687520	-77.0703660
2014	NCTCD2014-CAB1	Residential	Cabarrus	35.3933100	-80.7139100
2014	NCTCD2014-CAB2	Residential	Cabarrus	35.3435900	-80.5243200
2014	NCTCD2014-CAB3	Residential	Cabarrus	35.4220600	-80.4182200
2014	NCTCD2014-CHO2	Residential	Chowan	36.2191850	-76.7033920
2014	NCTCD2014-CHO1	Residential	Chowan	36.1648810	-76.6824490
2014	NCTCD2014-CRA2	Residential	Craven	35.2814173	-77.2972037
2014	NCTCD2014-CRA1	Residential	Craven	35.2796016	-77.3919819
2014	NCTCD2014-EDG1	Residential	Edgecombe	35.7917030	-77.5569370
2014	NCTCD2014-EDG2	Residential	Edgecombe	35.7628940	-77.5434410
2014	NCTCD2014-FOR2	Residential	Forsyth	36.1782566	-80.3372102
2014	NCTCD2014-FOR1	Residential	Forsyth	36.2270276	-80.2345634
2014	NCTCD2014-FOR3	Residential	Forsyth	36.1234406	-80.4435597
2014	NCTCD2014-FRA1	Residential	Franklin	36.1537500	-78.1066110
2014	NCTCD2014-FRA2	Residential	Franklin	36.1615400	-78.1693410
2014	NCTCD2014-GAS1	Residential	Gaston	35.2503000	-81.2954000
2014	NCTCD2014-GAS2	Residential	Gaston	35.2816600	-81.1770200
2014	NCTCD2014-GAT1	Residential	Gates	36.5428070	-76.8257810
2014	NCTCD2014-GAT2	Residential	Gates	36.5130510	-76.8411050
2014	NCTCD2014-GAT3	Residential	Gates	36.4275440	-76.8504580
2014	NCTCD2014-GRE1	Residential	Greene	35.3673121	-77.6299765
2014	NCTCD2014-GRE2	Residential	Greene	35.4099828	-77.5689943
2014	NCTCD2014-GRE3	Residential	Greene	35.4559030	-77.6686753
2014	NCTCD2014-GUI2	Residential	Guilford	35.9815698	-79.5578843
2014	NCTCD2014-GUI1	Residential	Guilford	35.9531860	-79.7395567
2014	NCTCD2014-GUI3	Residential	Guilford	36.1795372	-79.5768222
2014	NCTCD2014-HAL1	Residential	Halifax	36.4283310	-77.6006170
2014	NCTCD2014-HAL2	Residential	Halifax	36.3316040	-77.5970380
2014	NCTCD2014-HER1	Residential	Hertford	36.3873260	-77.0520900
2014	NCTCD2014-HER2	Residential	Hertford	36.4216730	-77.0902330
2014	NCTCD2014-JON1	Residential	Jones	35.2020414	-77.4932971
2014	NCTCD2014-LEN1	Residential	Lenoir	35.2820254	-77.6219501
2014	NCTCD2014-LEN2	Residential	Lenoir	35.3051942	-77.7921683
2014	NCTCD2014-LEN3	Residential	Lenoir	35.4098055	-77.5691275
2014	NCTCD2014-LEN4	Residential	Lenoir	35.3674054	-77.6305756
2014	NCTCD2014-MAR1	Residential	Martin	35.8127253	-76.8935338

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2014	NCTCD2014-MAR1	Residential	Martin	35.8467900	-77.1050500
2014	NCTCD2014-MAR2	Residential	Martin	35.8500500	-77.1508700
2014	NCTCD2014-MEC1	Residential	Mecklenburg	35.0870100	-80.8571800
2014	NCTCD2014-MEC2	Residential	Mecklenburg	35.2782200	-80.8350100
2014	NCTCD2014-MEC3	Residential	Mecklenburg	35.1066900	-80.7295200
2014	NCTCD2014-NAS1	Residential	Nash	35.9409262	-77.7915047
2014	NCTCD2014-NAS2	Residential	Nash	35.9012675	-77.8136233
2014	NCTCD2014-NAS3	Residential	Nash	35.8978504	-77.7402980
2014	NCTCD2014-NAS4	Residential	Nash	35.8179880	-77.8910230
2014	NCTCD2014-NAS5	Residential	Nash	36.0620040	-78.0136990
2014	NCTCD2014-NAS6	Residential	Nash	36.0785350	-78.0637760
2014	NCTCD2014-NHA1	Residential	Northampton	36.4147700	-77.6091630
2014	NCTCD2014-NHA2	Residential	Northampton	36.3887290	-77.4251660
2014	NCTCD2014-PIT1	Residential	Pitt	35.3696286	-77.3557370
2014	NCTCD2014-PIT2	Residential	Pitt	35.3688749	-77.4336679
2014	NCTCD2014-PIT3	Residential	Pitt	35.5974162	-77.3137415
2014	NCTCD2014-PIT4	Residential	Pitt	35.7542933	-77.1177064
2014	NCTCD2014-ROC2	Residential	Rockingham	36.5271368	-79.9150700
2014	NCTCD2014-ROC3	Residential	Rockingham	36.4606780	-80.0141598
2014	NCTCD2014-ROC1	Residential	Rockingham	36.5214135	-79.8212077
2014	NCTCD2014-ROW1	Residential	Rowan	35.5282000	-80.3731800
2014	NCTCD2014-ROW2	Residential	Rowan	35.5513600	-80.7207900
2014	NCTCD2014-STO1	Residential	Stokes	36.5357426	-80.3632553
2014	NCTCD2014-STO2	Residential	Stokes	36.5209089	-80.2877715
2014	NCTCD2014-STO3	Residential	Stokes	36.5064640	-80.1921094
2014	NCTCD2014-SUR3	Residential	Surry	36.5407477	-80.7445089
2014	NCTCD2014-SUR2	Residential	Surry	36.5342200	-80.5973800
2014	NCTCD2014-SUR1	Residential	Surry	36.5403286	-80.4708655
2014	NCTCD2014-WAR1	Residential	Warren	36.3886110	-77.4250000
2014	NCTCD2014-WAR2	Residential	Warren	36.4636110	-78.0105560
2014	NCTCD2014-WAY1	Residential	Wayne	35.4572983	-77.9193101
2014	NCTCD2014-WIL1	Residential	Wilkes	36.1805784	-81.2890285
2014	NCTCD2014-WIL2	Residential	Wilkes	36.2943874	-81.2133659
2014	NCTCD2014-WIL3	Residential	Wilkes	36.3714877	-81.1223070
2014	NCTCD2014-YAD1	Residential	Yadkin	36.1688983	-80.8624230
2014	NCTCD2014-YAD	Residential	Yadkin	36.2530805	-80.6452759
2014	NCTCD2014-YAD2	Residential	Yadkin	36.1314352	-80.5566207

Nursery Certification Program

NCDA&CS Plant Protection Specialists inspected 4,026 nursery dealers and nurseries during the 2014 season. Seven Stop Sale/Movement notices were issued to prevent the sale of infected or prohibited plants. These plants were either treated, destroyed or released after lab testing.

The data show a slight increase in the number of nurseries and the number of acres that were certified. This increase is believed to be a reflection of the improving economy and its impact on the nursery industry. The nursery dealer industry remained relatively unchanged in the state with quality nursery stock being offered to consumers. Several chain stores have expanded slightly which may also indicate an improving economy. The increases in nursery production as well as nursery dealer stability indicates the strength and staying power of North Carolina's nursery industry.

A license issued by the NCDA&CS is required by any person selling nursery stock in North Carolina. Nursery stock is defined as "all wild or cultivated plants or parts thereof, trees, shrubs, vines, bulbous plants and roots, grafts, scions and buds". Excluded in North Carolina's definition of nursery stock are "annual plants; cut flowers; tree, field, vegetable, flower or other true seeds; decorative plants or plant parts without roots not intended for propagation; and perennial plants intended for indoor use that are produced in North Carolina." A *nursery license* is required for any person growing and selling nursery stock whereas a *nursery dealer license* is required for any person obtaining and re-selling nursery stock. These licenses certify that plant material has been inspected for and is apparently free from potentially harmful quarantine pests and must be renewed yearly.

The NCDA&CS Plant Protection Section licensed 1,244 nurseries and 2,782 nursery dealers during the 2014 calendar year (Table 15). Of the 1,244 nurseries, 590 were registered nurseries and 654 were certified nurseries. A *registered nursery* has less than one acre of nursery stock and does not sell outside the state. A *certified nursery* has one or more acre of nursery stock and/or sells outside the state.

Table 15 Number of NC nursery and nursery dealer licenses by year^w

Calendar Year	Number of Licenses by Category			Total Number of Licenses	
	Registered Nursery ^x	Certified Nursery ^y	Nursery Dealer ^z	Nurseries (Registered & Certified)	Nurseries & Dealers
2013	515	548	2,821	1,063	3,884
2014	590	654	2,782	1,244	4,026

^wData based on receipt of license fees.

^xRegistered nursery – a location with less than once acre of nursery stock with no sales outside the state.

^yCertified nursery – a location with one or more acres of nursery stock and/or sales outside the state.

^zNursery dealer – a location where nursery stock is sold, usually to the end user, but not actually grown.

The primary objective of Plant Industry's Nursery Program is to facilitate the movement of nursery stock while preventing the introduction and spread of quarantine plant pests into and within North Carolina. The movement of infested nursery stock represents one of the ways plant pests may be moved

from one location to another and has the potential to directly impact both wholesale and retail nursery operations. North Carolina works to prevent such outbreaks by coordinating with other states and the nursery industry to bring awareness of threats to the state.

Stop sale/movement notices are issued when high levels of pests and/or prohibited plants are noted. Plants can either be treated and/or destroyed when a stop sale/movement notice is issued. Plants can be released for sale/movement if testing of the material confirms they are free of the suspected pest(s). During calendar year 2014, seven stop sale/movement notices were issued.

Phytosanitary Certification Program/ 2014 Export Certification Program

Within the Export Certification Program, Plant Protection Specialists issue phytosanitary certificates to growers and/or brokers to facilitate movement of agricultural commodities to other states and to other countries. Phytosanitary certificates indicate that inspections and other specific requirements of the importing states or countries have been met. State certificates are used for movement within the U.S., and federal certificates are required for movement to another country. Countries and states vary greatly in what they require for various types of commodities such that careful research and interpretation of requirements are needed for each request for phytosanitary certification. In 2014, federal certificates were issued for the movement of commodities to 86 countries, while state certificates were issued for 31 states and Puerto Rico. The majority of phytosanitary certificates issued were for lumber, tobacco, cotton, cotton seed, Christmas trees, peanuts, nursery and greenhouse plants, sweet potatoes, and sweet potato cuttings.

A phytosanitary certificate provides documentation that a plant, plant part, or plant-based product has been inspected and is apparently free of harmful pests. Each state and country has very specific import phytosanitary requirements that are tailored to protect their agricultural industries and natural environment from potentially harmful pests.

The NCDA&CS Plant Protection and Export Certification Specialists facilitate interstate and international movement of plants, plant parts, and plant-based products by issuing both state and federal phytosanitary certificates to North Carolina growers and brokers. State and federal phytosanitary certificates are issued for interstate and international movement, respectively. The NCDA&CS is responsible for implementing the state export program while the USDA is responsible for implementing the federal export program. However, the NCDA&CS works in collaboration with the USDA to issue federal phytosanitary certificates to support international export of plant-based products from North Carolina.

The USDA PCIT (Phytosanitary Certificate Issuance and Tracking) system has been used to issue both federal and state phytosanitary certificates by NCDA&CS since October 2009. The number of federal and state phytosanitary certificates issued using the PCIT system is included in Table 16. NCDA&CS staff issued 7,184 federal phytosanitary certificates and 348 state phytosanitary certificates in calendar year 2014. The number of federal phytosanitary certificates issued in 2014 represented a 7.9% increase over 2013 figures.

Table 16 Number of phytosanitary certificates issued through the PCIT^z system

Fiscal Year	Federal				State
	Plant or Plant Part	Re-export	Processed Plant Product	Total	Total
2009/2010 ^y	1,759	24	0	1,783	205
2010/2011	2,781	21	0	2,808	323
2011/2012	4,221	13	18	4,252	206
CY 2013	5,830	15	134	6,658	412
CY 2014	6,980	32	172	7,184	348

^z PCIT = Phytosanitary Certificate Issuance and Tracking (USDA web based application)

Plant Conservation Program

North Carolina Plant Conservation Board

The Plant Conservation Program (PCP) meets quarterly with members of the North Carolina Plant Conservation Board whose seven members are appointed by the Governor and the Commissioner of Agriculture. During January 2014 there were two changes to the list of Board members. Steve Henson was appointed by Governor McCrory as a representative of a conservation organization. Peter White of the North Carolina Botanical Garden retired at the end of 2014; he will continue to serve pending a Governor-appointed replacement of a North Carolina Botanical Garden representative.

North Carolina Plant Conservation Scientific Committee

The Program continues to meet regularly with members of the North Carolina Plant Conservation Scientific Committee. This seven member committee consists, primarily, of positions designated to the committee by law. Dr. Alvin Braswell retired from the N.C. State Museum of Natural Sciences December 31, 2014. The Museum recommended that he remain on the Committee. He will return to the Committee after a mandatory six month hiatus from State business.

Plant Conservation Preserve System

The Plant Conservation Program and Board have the regulatory authority to establish Plant Conservation Preserves to protect imperiled plant species. These Preserves are the only state-managed lands selected and designed specifically for plant conservation purposes. The Preserve system currently consists of 23 Preserves distributed across North Carolina (Figure 33). No preserves were added in 2014. However, an important “inholding” totaling 130 acres was added to the Boiling Spring Lakes Preserve in Brunswick County. PCP staff, with assistance from the State Property Office, and Friends of Plant Conservation made significant progress toward the acquisition of the Caraway Preserve in McDowell County. Closing is expected in 2015.



Figure 33 Plant Conservation Preserve System.

Preserve Field Trips

Although Preserves are not generally open to the public due to concerns about poaching, a number of field trips were led by Plant Conservation staff and partners to selected sites. Preserve tours were conducted at Big Pond Bay, Cedar Mountain Bog, Harvest Field, Rocky River-Morgan's Bluff, Mineral Spring Barrens, Ponderberry Bay Hebron Road, and Redlair Farm and Forest.

Clean Water Trust Fund Grants

Nearly all Plant Conservation Preserve acquisitions are funded by the CWTF. Applications were submitted for consideration in the spring of 2014 and one new grant was awarded:

- (1) Cedar Mountain Bog Plant Conservation Preserve-Transylvania County

Site Acquisition Planning

A systematic and comprehensive evaluation of site protection needs was updated this year. This "Portfolio of Important Plant Conservation Areas" continues to guide our efforts in working with land owners and managers across the state to better protect these critical sites. The PCP staff has coordinated with the North Carolina Clean Water Program staff to begin updating the portfolio in a Geographic Information System (GIS). This new version will include a scripted model generated in ArcGIS that reduces selection process time and effort, plus allowing for future changes in plant population statuses or newly discovered sites to be easily evaluated. The model will be an important part of a more consistent and efficient workflow for this necessary planning task.

United States Fish & Wildlife Service (USFWS) Partnership

The Plant Conservation Program and USFWS continued a long-standing cooperative agreement related to the recovery of endangered and threatened species in North Carolina. Grant funds obtained under this cooperative agreement provide critical funds to North Carolina each year. This cooperative agreement provides funding for a research specialist position, while a portion of the remaining funds have funded four temporary employees during the majority of this period.

Partnership Projects

The Plant Conservation Program is a member of several statewide or regional conservation partnerships and staff participates in these partnerships as time allows. The PCP has also continued to work closely in partnership with conservation organizations and land trusts across the state in land acquisition and management. Also of note, PCP has expanded its partnerships with the North Carolina Museum of Natural Science, the NCDA&CS Research Stations, and the North Carolina Forest Service (NCFS) offices and personnel around the state. In addition, staff regularly reaches out to the public with special presentations and by filling information requests.

Plant Conservation Preserve Management & Monitoring Activities

The Program continues striving to adequately manage preserves for the benefit of the rare plant species and habitats present on these sites and to conduct sufficiently detailed monitoring to determine the status of rare species at these sites.

The four member staff conducted 8 different prescribed burns during the year including two night burns. Each burn involved significant planning and preparation as well as mop-up after the burns were conducted. An additional prescribed burn was completed with the help of partner organizations and the

NCFS. At least one new rare species was located as a result of these burns: state threatened thick-pod white wild indigo (*Baptisia alba*) was discovered as a new species at Mineral Spring Barrens.

Steward Activity

Many of the management projects at the Durham Preserves have been enhanced with the reliable help from two volunteer stewards who travel from Wake County to participate in a variety of activities including prescribed burning, trash pick-up, invasives control, seed plot establishment, seed collection, guided tours, etc. Herb and Pat Amyx are heading up reintroduction efforts for smooth coneflower and smooth aster at our Durham County preserves. This year they have expanded this project to include tall larkspur. For several years they have helped collect seed and propagate seedlings to return to the appropriate preserves. These efforts have significantly increased the size of several of our smallest Smooth Coneflower subpopulations, and our only known population of Smooth Aster.

With the help of these stewards and other volunteers (one from out of state) we surveyed several sites for rare grass species; resulting in several new population discoveries on preserve lands.

The Bat Fork Bog volunteer steward, Tom Baugh, performed a variety of monitoring duties for the federally endangered Bunched Arrowhead (*Sagittaria fasciculata*). He assisted in improving the understanding of the spatial extent and spread of this species on the preserve.

Regulatory Programs

The Program is responsible for the protection and conservation of 419 plant species across North Carolina, of which 27 are also federally listed. Program staff meets quarterly with an interagency panel to review permit requests for projects affecting these protected plant species. Program staff continues to review requests for permits from individuals or institutions requesting to move or collect protected plants, including all state and federally listed plant species. This permit requirement applies to transplant and rescue projects, nurseries which propagate and sell protected species, public educational exhibits, as well as many scientific research projects. The review process incorporates input from the US Fish and Wildlife Service and the North Carolina Natural Heritage Program. Twenty-seven permits were issued and several additional requests were evaluated.

PCP worked with the Plant Protection Section in revising the procedures for the Certificate of Origin for Protected Plants by producing an updated form that nursery inspection specialists will use for nurseries selling listed plants. PCP staff also assisted in several nursery inspections involving imperiled plants. PCP fielded various questions from the general public on the correct procedures.

Venus Flytrap

The Scientific Committee recommended a status change for the Venus flytrap (from Special Concern Vulnerable to Threatened) due to new information about its threats and population trends in natural habitat. The Board approved this recommendation and will submit this status change after a review of the other species on the imperiled plant list. Staff received approximately 150 flytrap plants confiscated by Boiling Spring Lake Police and placed them in the care of Becky Westbrooks, instructor at Southeastern Community College in Whiteville. Staff and volunteers will re-plant these flytraps onto Boiling Spring Lakes Preserve in 2015.

American Ginseng

American Ginseng harvest and exports from North Carolina continued under regulations adopted by the North Carolina Plant Conservation Board. Without monitoring by the Program, harvest and export from North Carolina will not be allowed by federal authorities who have listed this plant under the Convention on International Trade in Endangered Species (CITES).

NCDA&CS certified over 7,000 pounds of wild collected ginseng during 2013. There were a total of 7,875 (dry) harvested during the season consisting of Wild, Wild-Simulated, and Woodsgrown. A total of 38 ginseng dealer license permits were issued during the 2013-2014 season



Figure 34 American Ginseng Root.

Plant Pathology Program

Boxwood blight

Boxwood blight is an important disease affecting *Buxus* (boxwood), *Pachysandra* (spurge), and *Sarcococca* (sweet box). The disease was first reported from North Carolina nurseries in October of 2011. Several nurseries experienced new infections of boxwood blight during 2014. One nursery each in Wake and Mecklenburg counties had boxwoods test positive for box blight during the summer. NCDA&CS assisted with disposal and destruction at both locations. Nursery owners are generally responsible for cleanup and destruction efforts but both requested assistance. To date, nurseries reporting box blight incidence are located in Surry, Ashe, Alleghany, Yancey, Mitchell, Wake and Mecklenburg counties.

In February 2012, NCDA&CS developed an optional “Boxwood Blight Statement Program.” Under the program, a North Carolina nursery receives a statement to accompany shipments into other states. The participating nurseries are signees to a compliance agreement and follow best management practices. In addition, growers agree to monitor boxwoods for disease symptoms, and participating nurseries may be subject to extra inspections conducted by NCDA&CS. To facilitate this program, the NCSU Plant Disease and Insect Clinic (PDIC) assays samples collected during this process at no charge. As of December 2014, there are 59 participants in the program.

In October 2014, NCDA&CS prepared and sent a letter to licensed nurseries concerning the risks posed by certain activities related to the use of boxwood as cut greenery. Boxwood greenery is a common component of holiday wreaths and garlands. The process of individuals going from field to field to cut this greenery is a possible pathway for the spread of boxwood blight. The letter urges growers to require sanitary precautions of all greenery cutters allowed in their fields.

In addition to the risks posed to nurseries by allowing people to cut greenery from their fields, using infected greenery in holiday decorations provides a pathway by which the disease can spread into home landscapes. Several retail locations stocked boxwood wreaths made with greenery infected with box blight during the 2014 holiday season. The NCSU PDIC confirmed the disease from samples collected. Both the greenery supplier and the affected retail stores were cooperative. One hundred seventy one wreaths were placed under stop sale and disposed of. NCSU PDIC staff posted information online advising buyers of fresh boxwood wreaths to dispose of wreaths in the trash instead of composting wreaths.

Export: Disease certification requirements and pathogen distribution information

Most agricultural commodities exported to foreign countries and to some U.S. states must meet certain requirements with regard to plant pests. Countries and states differ as to what is perceived as a plant pest risk. The Plant Pathologist received and handled requests from Field Specialists for assistance with interpretation of plant disease and nematode certification requirements and determination of pathogen distribution.

Export: Tobacco blue mold oospore survey (for certification of tobacco to China)

If blue mold of tobacco occurs in a state’s tobacco crop in a given year, that state must complete field surveys to detect the spores of the blue mold fungus in order to export tobacco to China. Survey procedures developed by USDA-APHIS-PPQ are required. The Plant Pathologist has been the coordinator for this program every year since it began in 2001. She updates the North Carolina survey

procedures yearly and sends them to the NCSU Plant Pathology Tobacco Extension Specialist for distribution to North Carolina Cooperative Extension Service (NCCES) personnel in the event that blue mold occurs. NCCES personnel conduct the survey by collecting samples from affected counties and submitting them to an approved lab (i.e., the NCSU Plant Disease and Insect Clinic). Industry groups pay for sample assays. Blue mold did not occur in North Carolina during 2014.

Export: Nematode certification

California has import requirements concerning reniform and burrowing nematodes. To assist nurseries that wish to send plants to California, Field Specialists collect soil samples and submit them to the NCDA&CS Nematode Assay lab according to procedures developed by the Plant Pathologist, who also provides oversight for this program. A sampling table based on numbers of plants or area sampled was developed by the Plant Pathologist. Using this table enables growers to pre-determine costs prior to sample collection and submission. [Note: Reniform and burrowing nematodes have not been found in any North Carolina nursery. Reniform nematode was previously found in eight North Carolina counties under agronomic field conditions, but burrowing nematode has never been found at any location.]

The Nematology Assay Section (NAS) Chief cooperates with the Plant Pathologist to test routine samples for soybean cyst nematode (SCN) in order to validate new-county detections. SCN was not detected in any new county in North Carolina during this reporting period.

Import: Movement of plant pathogens for research and other purposes

The USDA-APHIS-PPQ Form 526 (“Application and Permit to Move Live Plant Pests or Noxious Weeds”) permits the movement of plant pathogens and other pests into North Carolina for research, diagnostic identifications, or commercial uses. The Plant Pathologist has the responsibility of providing comments to address state-specific concerns regarding each application. USDA-APHIS-PPQ issues final approval or denial of each application. All plant pathogenic organisms are subject to this requirement. The risk associated with each organism is evaluated to ensure that adequate safeguards are listed in the conditions of the permits. During 2014, twenty-nine permit applications were evaluated. Organisms requested included 236 fungi/oomycetes, 9 bacteria, and 2 nematodes.

Nursery Inspection: Submission and diagnosis of problem plant samples

The Plant Industry Division does not maintain a lab for general diagnostic purposes. Plant Protection Specialists collect problem plant samples from nurseries during nursery inspections and submit them to the NCSU Plant Disease and Insect Clinic for diagnosis and control recommendations. The Plant Pathologist serves as the liaison between the specialists and the Clinic, assisting with interpretation of diagnoses and recommendations when necessary.

Sudden Oak Death (SOD)

Nursery surveys

Sudden Oak Death/ramorum twig and leaf blight caused by the plant pathogen *Phytophthora ramorum* is killing thousands of oak trees in California and Oregon. To prevent artificial movement out of the known infested areas, shipments of nursery host plants are regulated by federal and state quarantines. Field personnel have been involved with conducting nursery surveys and regulatory inspections for this disease since 2004. In 2014, NCDA&CS received federal Farm Bill funding to conduct surveys for *P. ramorum* and a related pathogen, *P. kernoviae* in nurseries and garden centers. Efforts were focused on retailers in more populated cities to account for larger volumes of

plant movement. Specifically, the metropolitan areas of Charlotte, Greensboro and Raleigh were targeted. Additionally, several wholesale nurseries, were included in this survey. *Phytophthora ramorum* and *P. kernoviae* share some common hosts and both pathogens affect stem and leaf tissue. For efficiency, both pathogens were surveyed simultaneously. Visual inspections were conducted at each survey location in May and June. The survey was extended during September and October to include plants arriving at retail locations during the fall season. A total of 41 survey sites were visited across 14 counties. A total of 103,729 plants were surveyed. Symptomatic host plants were sampled and submitted to the state plant pathologist for testing for the presence of *Phytophthora* using enzyme-linked immunosorbent assay (ELISA). Forty-nine samples were submitted of which three were *Phytophthora* positive. *Phytophthora* positive samples included two *Pieris japonica* and one *Rhododendron catawbiense* 'Album.' All samples that resulted in a positive ELISA test, were sent to Kansas State University-Manhattan Diagnostic Laboratory for further diagnostics. There were no positive identifications of the target pathogens in any of the samples screened during this survey.

Recurring positive location

Ornamental plants at a nursery dealer in Mecklenburg County have tested positive for the plant pathogen *Phytophthora ramorum* at various times since the first detection in 2008. Although there were no positive plant or soil detections in 2011, a positive camellia was confirmed in April of 2012. As a result of the April 2012 detection, follow-up surveys must be completed twice a year for two years without a subsequent positive detection in order for this location to be cleared from extra inspection requirements, per USDA mandate. All plants sampled in 2013 tested negative for *P. ramorum*. Despite the absence of symptomatic plants, the pathogen remains detectable in water both inside and outside the location.

Trace-forward/trace-back notifications

Three trace-forward notifications concerning Oregon nursery plants were received from USDA-APHIS-PPQ in 2014. One notification involved only one plant, *Gaultheria shallon*, which the buyer provided to NCDA&CS for further testing and disposal. A separate notification involved *Rhododendron* and *Camellia* plants sent to seven homes across seven counties. In each case, Plant Protection Specialists sampled symptomatic plants and sent samples to the Plant Pathologist for ELISA testing. A third trace-forward notification involved *Rhododendron* and *Pieris* plants that were sent to 20 retail stores in 14 counties and involved over 2400 total plants. All stores were visited and symptomatic plants were tested. No plants sampled during any of the three trace-forward notifications tested positive for *Phytophthora ramorum*.

Miscellaneous SOD activities

The Plant Pathologist participated in monthly, national conference calls pertaining to the Sudden Oak Death program and provided summaries to the Plant Pest Administrator. Monthly conference call participants routinely discussed issues such as: changes to national regulations, current trace-forward/trace-back investigations, updates from regulated states, on-going research, and workshop/training announcements.

Tobacco Plant Inspections

The North Carolina Tobacco Plant Certification Regulation requires anyone who moves tobacco plants into North Carolina from another state to do so under an import permit system. There were no import permit applications received during this reporting period. Another aspect of the regulation requires that

plants grown in North Carolina and sold for planting in a location more than seventy-five (75) miles away from the place of production must be inspected and certified. A major reason for this requirement is to prevent the artificial movement of blue-mold or virus-infected plants from one growing region into another, which could initiate a premature disease epidemic. There were no certified tobacco plant nurseries during this reporting period.

Vegetable Plant Inspections

The Vegetable Plant Certification Regulation requires weekly inspections and certification of vegetable plants grown in North Carolina for sale to commercial growers. There were no vegetable plant nurseries certified under this regulation during this reporting period. The North Carolina Crop Improvement Association (NCCIA) certifies a large number of sweet potato cuttings and “seed” under its certification program. Because NCCIA certification requirements meet or exceed the standards of the vegetable plant regulation, NCDA&CS accepts inspections and certification tags of NCCIA in lieu of its own.

White Pine Blister Rust

White Pine Blister Rust Regulations prohibit the growing of *Ribes* species (currants and gooseberries) in North Carolina because they serve as alternate hosts to the white pine blister rust pathogen. This regulation must be reevaluated before January 2019 by legislative mandate. Work on the reevaluation has begun and will include consultation with representatives of the North Carolina Forest Service, US Forest Service, and North Carolina State University as well as other state departments of agriculture that have lifted similar *Ribes* bans in recent years.

Forest Pest Outreach

NCDA&CS was awarded federal Farm Bill funding to conduct forest pest outreach activities. The primary outreach strategy employed by NCDA&CS was the delivery of oral presentations to key stakeholder groups. Over the duration of the cooperative agreement, over 300 individuals attended oral presentations given by the cooperator concerning invasive forest pests. During this time, seventeen presentations were given. Presentations generally covered the most imminent invasive pest threats to North Carolina forests, namely, Asian longhorned beetle, emerald ash borer, redbay ambrosia beetle/laurel wilt disease, Asian gypsy moth, and walnut twig beetle/thousand cankers disease of black walnut. Information on basic identification techniques and pest biology was provided. In addition, participants were encouraged to report suspicious looking pests or damage to a phone number hotline or email address which NCDA&CS maintains for new pest reports from the public. Audiences were composed of 150 Master Gardeners, 25 agricultural extension agents, 30 private landowners, 25 state park rangers, 100 college students, 4 college department heads, numerous teachers and scientists, and several city arborists.

In addition to oral presentations, outreach efforts took advantage of relevant public events. In order to provide outreach targeted at the general public, NCDA&CS set up booths at the North Carolina Museum of Natural Science’s “BugFest,” which is attended by over 30,000 people; the North Carolina State Fair, attended by nearly one million; and the North Carolina Future Farmers of America (FFA) Convention, attended by 2,000 high school agriculture students and teachers. Outreach efforts at the North Carolina State Fair were paired with those of the North Carolina Forest Service and focused on the “Don’t Move Firewood” message. Materials targeting children, such as coloring pages, word finds, and mazes, featuring the emerald ash borer and Asian longhorned beetle were created and distributed to BugFest attendees. Educational packets were mailed to agriculture and general biology teachers for further use in the classroom, based on contacts made at the North Carolina FFA Convention. Further efforts targeting

the general public included the production of posters showcasing invasive forest pests and information regarding movement of firewood. These posters were provided to each state-managed farmer's market in North Carolina.

Posters, as well as over 5,000 informational brochures were also provided to various state park points of contact upon request. A spreadsheet was developed and maintained to track volunteer groups, audiences for invited talks, points of contact, resources created and distributed, and attendance at major public events.

Other activities related to plant pathology

During this reporting period, the Plant Pathologist was involved with other plant disease issues. Examples include:

- Answered questions from the public as they relate to the White Pine Blister Rust Quarantine, as well as general plant problems.
- Served as the contact between NCDA&CS and state and federal labs involved with testing North Carolina plant samples for *Phytophthora ramorum*, *Ralstonia solanacearum*.
- Reviewed commodity import pest risk assessments prepared by USDA-APHIS-PPQ and considered the impacts of resulting trade changes for North Carolina agriculture and natural resources.
- Continually reviewed scientific literature pertaining to new plant disease occurrences and research; developed archive of important sources and articles for future reference.
- Expanded database of *Phytophthora* species of potential concern with information such as: plant part(s) affected, symptoms, sampling methods, in order to stay abreast of future threats and ensure we sample and test for as many *Phytophthora* spp. as possible when conducting surveys.
- Participated in windshield surveys for laurel wilt disease of redbay with North Carolina Forest Service personnel.
- Attended relevant scientific meetings/seminars including the Southern Appalachian Forest Entomology and Pathology Seminar, the North Carolina Nursery and Landscape Association's Green & Growin' Show, The Southern Farm Show and the Plant Pathology Society of North Carolina annual meeting.
- Participated in quarterly meetings of the North Carolina Pest Risk Committee.
- Worked with Plant Pest Specialist, nursery and the NCSU Plant Disease and Insect Clinic concerning likely occurrence of a new pathogen, *Kosakonia cowanii*, on verbena in a major wholesale nursery operation. Infected plants were destroyed.
- Worked with Plant Pest Specialist, nursery and the NCSU Plant Disease and Insect Clinic concerning occurrence of the stem and bulb nematode, *Ditylenchus dipsaci*, on hydrangea in a nursery. Conflicting reports exist regarding the prior presence of this nematode in North Carolina.
- Began serving on the National Clean Plant Network - Berries group, Tier II board. This group meets annually and discusses funding priorities, national clean plant standard harmonization, and outreach efforts concerning micropropagation technologies and the need for clean plant standards.

Regulatory Weed Program

The North Carolina Regulatory Weed Program protects North Carolina agriculture, public health, and native plant ecosystems from the harmful impacts of noxious weeds. The regulation of noxious weeds is authorized by the North Carolina Plant Pest Law and the Aquatic Weed Control Act of 1991. Program activities include inspections, issuance of Phytosanitary Certificates, issuance of Scientific Permits for movement of regulated articles and the survey, control and eradication of listed noxious weeds. The Witchweed Eradication Project, funded by USDA-APHIS-PPQ, is also a vital part of the Regulatory Weed Program.

Program Accomplishment Highlights

Witchweed Eradication

- The witchweed program continues to make gains in released acres in spite of the discovery of new or re-infested fields. The total acreage of active fields (i.e. fields with fewer than 5 points) is now 1,134 acres in North Carolina.
- 2,547 acres were treated in North Carolina as part of the witchweed eradication program
- A total of 77,735 acres were surveyed to evaluate status of witchweed infestation in southeastern counties of North Carolina.

Tropical Spiderwort

- A new significant infestation of tropical spiderwort (*Commelina benghalensis*) was found at the Cherry Research Farm. Thirteen acres were found to be infested in the conventional portion of the research station, and fumigated in November 2014. Most of the infested acreage is still located within the Farming Systems Research Unit (FSRU) of the Cherry Farm. The number of detected plants in the FSRU continues to decrease.

Other Noxious Weeds

- A small infestation of Crested Floating Heart, (*Anoda cristata*) was discovered by Andrew Allen (NCDA&CS) in Forsyth County in a small pond in May 2014. This was the first documented occurrence in North Carolina. An application of the herbicide Hydrothol 191 was applied by staff from NCSU and NCDA&CS two times during the season. Monitoring and control efforts will continue in 2015, as the submerged vegetation is difficult to control. Other sites have been reported in Jackson and Franklin counties and they will be investigated in 2015.
- Eleven tropical soda apple plants (*Solanum viarum*) were found during the 2014 survey at Martin Meats and Coharie Farms in Sampson County. The plants were bagged and incinerated.
- Small broomrape (*Orobanche minor*) continues to be confined to only a few plants in several locations of Mitchell County. Annual surveys are necessary to find the plants and destroy them to prevent additional spread. A small infestation was discovered on May 23, 2012 at the Western North Carolina Regional Livestock Center near Canton. Treatment with propane burners was done in June, 2012 and herbicides were used in 2013 and 2014.
- Purple loosestrife (*Lythrum salicaria*) is still confined to only a few plants in Forsyth County and at several other locations throughout the state. Annual surveys are necessary to find the plants and treat them with herbicide to prevent spread. A new large infestation was confirmed near the Henderson County Airport in Hendersonville, North Carolina in 2013. Survey and treatment is continuing at that site. A new site with only several plants was also confirmed near a North Carolina Department

of Transportation (NCDOT) project near Greensboro in 2013. These plants were pulled by the landowner.

- Approximately 1,700 acres were surveyed for the presence of itchgrass (*Rottboellia cochinchinensis*) in Robeson County. A new site east of I-95 was discovered by Michelle Shooter (NCDA&CS) in 2014. Glyphosate was applied during summer/early fall of 2014 to control emerged plants and escaped plants were hand-pulled and disposed of. The site was monitored, and a treatment plan is currently being developed for the area in coordination with Derek Smith of the NCDOT.
- Efforts continued to evaluate efficacy of weevil releases as a biocontrol agent for mile-a-minute vine, *Persicaria perfoliata*, in both Alleghany and Yancey Counties.
- Giant hogweed (*Heracleum mantegazzianum*) has been confirmed at 5 separate sites in Watauga County. Herbicide treatment and hand-pulling were both utilized to control these infestations in 2014.
- A small infestation of Cogongrass was found in Martin County on June 5th, 2014 by an employee of the North Carolina Cooperative Extension Service. Herbicides were used to control the infestation, and no other infestations were found. Another small population in Stanley County was also found and treated.

Regulatory

- 77 phytosanitary certificates were issued to support the witchweed quarantine program. The number has decreased in recent years because of the issuance of compliance agreements with several cooperators.

Public Relations and Outreach

- The NCDA&CS Weed Specialist served as a committee member of the North Carolina Aquatic Weed Council as well as a member of the Aquatic Nuisance Species Workgroup. The Weed Specialist also manned a booth at the North Carolina State Fair in October 2014, speaking with the public about our role in agriculture.
- A presentation about invasive terrestrial weeds that are still in the early detection and rapid response stage in North Carolina was made to attendees of the North Carolina Vegetation Management Association in December 2014. Numerous questions were answered, and several attendees provided tips on infestations on their property. Approximately 100 people were reached in this seminar.
- The Weed Specialist provided a guest lecture to approximately 50 NCSU students enrolled in the CS 111 course (Field Crop Production). The seminar provided an overview of invasive plants present in North Carolina and regulatory issues.
- The Weed Specialist served a member of the review panel for the 2014 Bioenergy Research Energy Granting Program.
- On numerous occasions, assistance was provided to help identify weeds and provide weed control recommendations in crop, turf, aquatic and non-crop sites.

Aquatic Dealer Inspections

Aquatic dealer inspections are completed each year by the Plant Pest Specialists. In 2014, approximately 48 aquatic plant dealers were inspected in North Carolina. No significant issues were discovered during inspections. As part of the inspection process, the Plant Pest Specialists also advised dealers to inform customers about the importance of not disposing of aquatic plants such as water hyacinth, parrot feather and water lettuce into outdoor water bodies. The revised aquatic dealer inspection forms have provided a more effective tool for doing aquatic dealer inspections.

Weed Survey and Eradication Program Details

Survey Methodology and Rationale

Surveys for all projects were done by visual reconnaissance. Survey objectives are: 1) identify new infestations of target noxious weeds (i.e. detection surveys); and, 2) delimit the boundaries where the weeds were mapped in previous years (i.e. delimiting surveys). Detection survey location targets were selected based on probability that the subject plant pest would be present. In some instances GPS coordinates were recorded to provide reference points for mapping and relocating, if needed.

Roadsides close to wet areas and home landscapes were targets for purple loosestrife detection surveys. Locations known to have been infested with small broomrape (*Orobancha minor*) in the past were checked in spring or early summer for reoccurrence of the weed. Also, past known locations for itchgrass (*Rottboellia cochinchinensis*) were surveyed in June through October to monitor results of herbicide treatments in 2011, and to ascertain new infestations. Cattle slaughter houses and holding farms in Sampson County are surveyed twice annually for infestations of tropical soda apple. Since plant species must be identified during the growing season, all surveys are done during the period from full leaf (June) through the first hard freeze (usually mid November).

Results Of Active Weed Control Programs

Broomrape (*Orobancha minor*)

Surveys in Mitchell County were completed by NCDA&CS Plant Pest Specialists, Tim Hartley and James Corbin during April and May with no new detections noted.

Orobancha minor was discovered by Rebecca Norris and Kathy Kidd at the Western North Carolina Livestock Center near Canton, North Carolina in 2012. The infested area was burned with propane torches in 2012 to kill surface seed. The site was monitored during 2014 and treated as needed with a broadleaf herbicide to eliminate clover, which is a host plant of *Orobancha minor*. Approximately 15 plants were removed by hand in 2014, in a location measuring 5ft X 5ft.

Bushkiller (*Cayratia japonica*)

Bushkiller continues to be discovered in new locations across the state, most notably in Durham and Charlotte. Current infestations are being contained and in some instances, where eradication is the goal, only occasional plants are found. Infestations at Reynolda Gardens, and the Old Salem Cemetery cover the most area. The goal at these sites is containment.

Chinese Water Spinach (*Ipomoea aquatica*)

An inspector from USDA-APHIS-PPQ, Philip Monroe, found two Asian markets selling Chinese water lettuce in Cary and Wilmington during November and December 2014. The source for one location is a restaurant in Georgia, USA – where Chinese water spinach is prohibited. Compliance agreements will be issued to both store owners to allow continued sale of the product.

Cogongrass (*Imperata cylindrica*)

A naturalized colony of cogongrass was discovered for the first time in North Carolina by the Pender County Horticulture Extension Agent, Charlotte Glen in 2012. Cogongrass is considered a serious invader due to its ability to establish on a variety of soils and sites and ability to change ecosystem

function by creating conditions for more frequent and hotter fires. It is a Federal Noxious Weed that continues to invade thousands of acres across the Southeastern United States.

The cogongrass infestation was located a few miles south of Wallace on county-owned property that was once a home site. The area infested is estimated to be less than 4,000 square feet in size.

The infested area was treated with herbicides in June 2012. In addition, approximately 292 miles of roadsides surrounding the infestation were surveyed on June 20, 2012. No additional cogongrass plants were found during the survey. The patch of cogongrass was burned on June 20 to aid in detecting re-sprouts as the site was monitored during the 2012 growing season. No significant re-sprouting has been noted in the time since the original detection. The site has been surveyed twice a year since the original infestation. The Weed Specialist determined that monitoring of the site was no longer needed. Plant Pest Specialist, Scott Cannady, travels by the location once a month and has not observed any further cogongrass infestations.



Figure 35 Burning of cogongrass in Stanly County, 2012.

In June 2014, a new location of cogongrass in Williamston was discovered by Thomas Campbell, Extension Agent in Pasquotank County, and confirmed by NCDA&CS employees. The small stand was located on the side of the road at the intersection of Prison Camp Road and Old Hwy 64 Business. Herbicide sprays of glyphosate were applied on June 10th by Plant Pest Specialists David Pearce and Randy Copeland. Follow-up visits to the site by Bonnie Faulkner on June 16th and July 17th, 2014 revealed that the grass was dying or dead.

In 2014, a new cogongrass site was also discovered in Stanley Co at the intersection of Hwy 27 and Anderson Church Rd, by an employee of the Forest Service. The patch was small; approximately 50 square feet. Seeds were sent to Texas to check for viability and all came back sterile. The Forest Service is treating the patch with Arsenal and will continue to monitor. Employees of NCDA&CS scouted the surrounding area and found no additional cogongrass.



Figure 36 Plant Pest Specialists scouting a new Cogongrass site in Williamston, NC in June 2014.

Crested Floating Heart (*Nymphoides cristata*)

Crested floating heart is established in south Florida, and was first discovered in Lake Marion, in the South Carolina Coastal Plain, in 2006. It has proven to be extremely difficult to manage in both states. Crested floating heart was first discovered in North Carolina in May of 2014 in a private pond in Guilford County. Hydrothall 191 was applied by NCSU field staff on September 17th and October 3rd, 2014. The site will continue to be monitored and sprayed in 2015 for any additional vegetation. Several other sites have been reported by landowners around the state, and will need to be verified by the State Weed Specialist.

Giant Hogweed (*Heracleum mategazzianum*)

Giant hogweed is a Federal Noxious Weed that was first officially reported in the state in 2011. Exposure to the sap causes a skin reaction known as photodermatitis that results in large painful blisters with eruptions (*similar to poison ivy – but much worse*). If exposed to sunlight, the blisters leave permanent purple scars.

There are five sites in Watauga County where giant hogweed has been located. The following list of sites (and accompanying GPS coordinates) describe the number of plants counted and treatment if it was needed for 2014.

Site one: (36.15037, -81.66012) No new plants have been found at this site in two years

Site two: (36.13680, -81.67685) This was the original site. There were two plants located here in 2014 and they were sprayed with a 2% solution of glyphosate in June of 2014. Subsequent checks through the summer yielded no new plants.

Site three: (36.12144, -81.74338) This was the source for the plants at site two. The check in June of 2014 yielded 37 new plants. They were sprayed with a 2% solution of glyphosate as well. Subsequent checks through the summer yielded no new plants.

Site four: (36.11989, -81.74354) This site was a new find in 2013. In speaking with the land owners, it was discovered that the plants came from site three. They were sprayed with a 2% solution of glyphosate in 2013 and no new plants were discovered in 2014.

Site five: (36.11446, -81.77836) This site was also a new find in 2013. Origin is unknown. There were over 100 plants upon discovery and the seed heads were removed and burned. The plants were sprayed with a 2% solution of glyphosate. Inspection in 2014 revealed 39 new plants growing. The origin of plants at sites number 1 and 3 is unknown.

Hydrilla (*Hydrilla verticillata*)

A 2011 survey of 194 boat ramps surveyed for the presence of hydrilla showed a risk that hydrilla could spread to other bodies of water if boats and trailers are not checked and cleaned before leaving the ramp. Twelve ramps at the following bodies of water showed the presence of hydrilla: Chowan River, Lake Gaston, Roanoke River, Roanoke Rapids Lake, Kerr Lake and Shearon Harris Lake. The list was provided to the Water Resources Division of the Department of Environment and Natural Resources and the Wildlife Resources Commission for consideration in planning the aquatic weed control program.

Hydrilla was found in Lake Waccamaw in 2012. An estimated 698 acres were infested (Figure 37). There are 28 rare species in the lake – including 11 mollusks, 4 fish and 13 other plants, making treatment efforts complex. Multiple state agencies banded together to put out herbicide treatments on the lake in 2014 at an estimated cost of \$486,000. Projected costs for treatment over the next 6-8 years is \$4.3M

Hydrilla has also been found in the Eno River. The problem is complex because the flowing water complicates herbicide application, and there are many jurisdictions including the City of Hillsborough, City of Durham and City of Raleigh. Also, the river is sourced for municipal water supplies, and the Eno River Association is opposed to herbicide use. A technical committee was formed in 2013 to develop a strategy for managing the Eno hydrilla infestation, and the State Weed Specialist is a member of that committee. It is estimated that \$50,000 will be needed each year for several years. Hydrilla is completely infesting all sections of the river in Eno River State Park.



Figure 37 Lake Waccamaw estimated hydrilla infestation based upon hydrilla presence, % on rake, and biovolume.
Source: Rob Richardson, NCSU.

In November 2014, a homeowner contacted the State Weed Specialist with a report of hydrilla in a private pond in her neighborhood in Randolph County (Figure 38). The weed specialist, Bridget Lassiter, and Plant Pest Specialist Andrew Allen surveyed the pond, as well as 6 other ponds in the neighborhood. Three ponds were found to contain hydrilla. A plan was created for the homeowner and she plans to work with the homeowners association to manage the weed in 2015.



Figure 38 Private pond in Randolph County with a significant population of hydrilla.

Itchgrass (*Rottboellia cochinchinensis*)

Itchgrass is a Federal Noxious Weed, and poses problems because when touched, it can cause contact dermatitis to skin. Efforts to control this weed in Robeson County have been ongoing since the early 1980's. It was thought that the weed was eradicated in 1988, however it was detected again in the late 2000's.

Fields in Robeson County were extensively surveyed in 2011 to indicate infested areas (Figure 39). Approximately 1,700 acres were surveyed and treatments of glyphosate were applied along field borders and ditches where standard weed control practices were not implemented by the growers to maintain soybean and corn crops. Surveys indicated 57 fields (totaling 1,090 acres without itchgrass) and 35 fields (600 acres) with spots of itchgrass mainly along field edges and in rights-of-ways.

Roadside itchgrass sites were treated with pendimethalin in 2012 and 2013 in cooperation with Derek Smith at the North Carolina Department of Transportation (NCDOT). One new itchgrass site was located in June 2014, on the east side of I-95. This is the first time that a location of itchgrass has been found east of I-95. It is thought that a roadside mower might have spread the seed along one side of the road in that area. Infestations were located and flagged by Michelle Shooter (NCDA&CS).

Post emergence glyphosate applications were made by both Michelle and a local farmer, Kay McGirt, throughout the growing season at intervals of 1 month when plants were located. Plants with seed heads were hand pulled and disposed of in plastic bags in November of 2014. Cooperation is ongoing with NCDOT in the 2015 growing season to control the infestation of itchgrass.

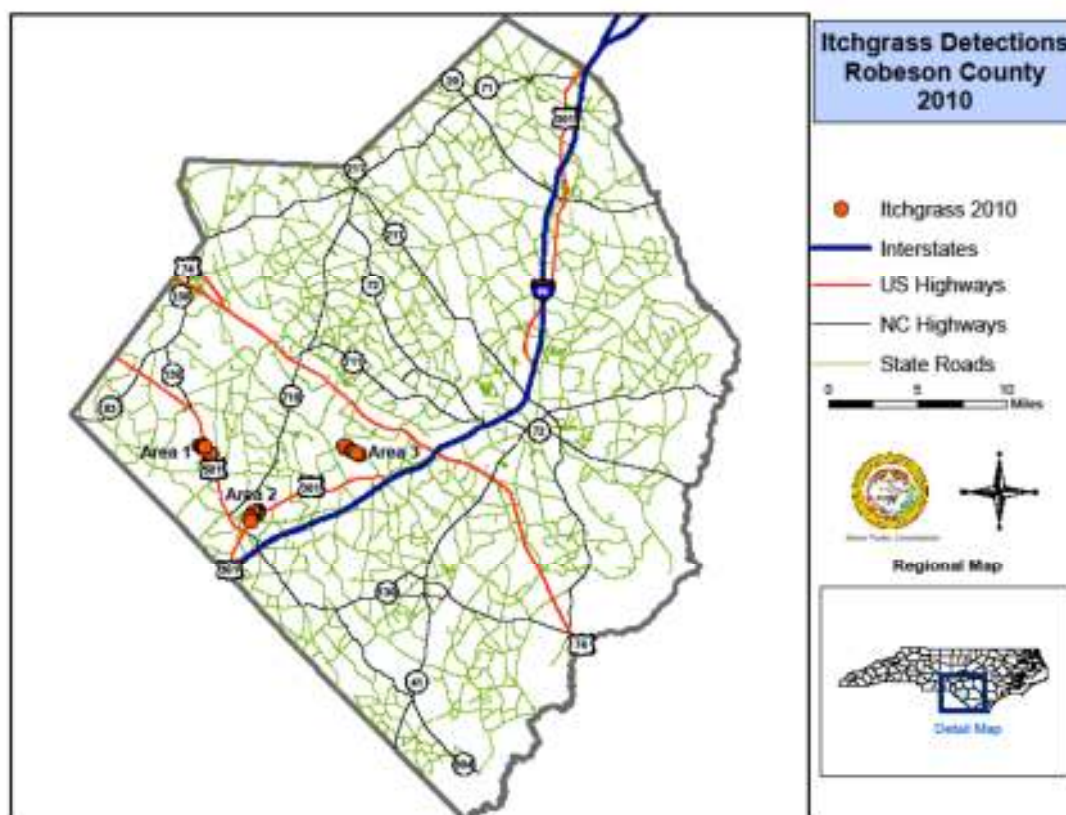


Figure 39 Map showing 3 general areas where itchgrass has been found in Robeson County.



Figure 40 Itchgrass site east of I-95 in Robeson County, Summer 2014.

Mile-a-minute vine (*Persicaria perfoliata*)

Mile-a-minute (MAM) vine is documented in the following North Carolina counties: Alleghany, Gates, Guilford, Pasquotank, Perquimans, Rockingham, Watauga and Yancey counties. In 2013 a new population was found along the Mayo River in Mayo River State Park, downstream from a known infestation. During 2014 Park Superintendent Keith Martin recorded several more populations along the river.

Since 2011, biological control of MAM vine has been underway in North Carolina under the supervision of Kathy Kidd (Biocontrol Administrator, NCDA&CS). To date, 14,700 weevils have been released in 5 counties, and release sites are being monitored. Observations have shown that the weevils are surviving the winters in most locations in North Carolina, and are causing measurable control of this weed. More about this biocontrol effort is contained in another section of this report that describes projects of Plant Industry's Biocontrol Laboratory.



Figure 41 Mile a minute vine. An annual climbing vine that has spines and blue berries.

Oriental bittersweet (*Celastrus orbiculatus*)

Each year, Plant Pest Specialists responsible for counties within the oriental bittersweet quarantine area, distribute colored warning tags that retail outlets are encouraged to provide with all purchases of oriental bittersweet. The tags warn purchasers that oriental bittersweet is an invasive plant that should be disposed of in plastic bags destined for landfills and that disposal in a natural setting or mulch piles could lead to establishment of this serious invasive plant.

Farmers markets in Asheville, Greensboro and Raleigh were inspected for oriental bittersweet in 2014, but no stop sale notices were issued.

Purple Loosestrife (*Lythrum salicaria*)

Sixteen sites near Winston-Salem were surveyed in May, August, and September, 2012 (Table 17). A few scattered loosestrife plants were detected and treated at several of the sites. The plants were treated with a 1.5% solution of Element 3A (triclopyr). The sites were monitored in 2013 and 2014, with additional herbicide treatments applied as necessary.

Table 17 Purple loosestrife sites and acreages treated near Winston-Salem, NC.

Site	GPS Latitude	GPS Longitude	Acres
I-40 West	36.07042893	-80.15678182	4.51
Rec Center	36.07213056	-80.15496865	2.03
Substation	36.07111048	-80.15596175	7.66
Farmingdale	36.08209177	-80.15750794	1.71
Oak Grove Church Rd	36.08275462	-80.1357344	0
Megahertz	36.05817098	-80.17106929	1.97
Krispy Kreme	36.0562938	-80.17078946	0.79
Corning Plant	36.05567246	-80.17498931	2.05
Goose Pond	36.0535053	-80.18703683	7.83
Chaucer Lane	36.05043841	-80.18960097	3.82
Fox Meadow	36.0357447	-80.19275031	1.75
Villas	36.04122216	-80.20579241	0.57
1-40 East Pasture	36.0686042	-80.1563407	1.46
Wallburg	--	--	2.23
White Church/Hwy 109	36.04627997	-80.19543131	0.85
Willshire Golf Course	--	--	3.32
Total Acres			42.55

Purple loosestrife was also discovered in 2011 in Henderson County. Two sites are being treated – one occupying several acres at the Henderson County airport. The site was discovered by a stewardship biologist with the North Carolina Wildlife Resources Commission. The second site (across the road from the airport) encompasses 20 acres; which includes two soybean fields, an alley between the fields, and the City of Hendersonville sewer line right-of-way.

Herbicide treatments at the site are ongoing in cooperation with the Wildlife Resources Commission (Kelly Hughes treating the edges of the soybean fields and areas in Jackson Park) and the City of Hendersonville (treating areas of the sewer line that are infested with purple loosestrife). On June 2, 2014 the entire area was scouted and sprayed with a treatment of glyphosate. A follow-up treatment was made on July 10th where the blooming tops were cut and sprayed, as well as a basal treatment to all of the remaining plants. Additional follow-up treatments were made on September 24th and 25th 2014.

Tropical Soda Apple (*Solanum viarum*)

Tropical soda apple is a Federal Noxious Weed. The plant is large and spiny but cattle prefer to eat the plant's fruits. On July 30th and October 1st 2014, Martin Meats in Sampson County was surveyed and there were no plants found either time. It is believed that the owner of this company has not been importing cattle from Florida this year, and has instead starting bringing in hogs. This would severely reduce the number of tropical soda apple seeds that would be brought into North Carolina.

On July 30th and October 1st 2014, Faircloth Farm in Sampson County was surveyed. During the July survey, 4 plants were found, but they were small with no visible fruit. During the October survey, 13 plants were found and 4 of them had fruit on them. All plants were pulled and disposed of in paper yard waste bags and incinerated.

Tropical Spiderwort (*Commelina benghalensis*)

Tropical spiderwort is a Federal Noxious Weed, and has several methods of reproduction, including underground flowers and tubers. Propagation of this plant can occur from stem cuttings, seed or tubers. Several locations of the plant have been found in North Carolina since 2001, but the quarantine area is currently confined to one location in Wayne County. The quarantine for tropical spiderwort remains active at the Cherry Research Farm near Goldsboro. Historically, at the Cherry Farm the infestation has been confined to the Farming Systems Research Unit. One employee there works every day during the summer to flag, pull and burn any tropical spiderwort plants that are found in the Farming Systems Research Unit.

Unfortunately, tropical spiderwort was found in one of the conventional fields. This is the first time in several years that the plant has been found in the conventional part of the farm. This field, located directly behind the equipment sheds, was planted to corn for silage, and totaled 13 acres. Tropical spiderwort was discovered in the field in September 2014, after the corn had been cut for silage.

In November, the field was disked and methyl bromide was applied to the entire 13 acres by Tri-Est Ag Group, Inc. (Figure 42). Approximately two weeks later, the plastic was removed. The cost of this treatment was \$38,000. The field will remain fallow for the 2015 growing season to monitor the site for any weed growth. In addition, fields adjacent to the silage pit will be monitored during 2015 for any new weed growth. The weed specialist plans to conduct meetings with Research Station Staff to remind them of the importance of sanitation in the coming years.

All visitors to the Cherry Research Station are asked to sign in at the Tropical Spiderwort Quarantine area, and keep a log of visits to the wash station. Ann Gallagher, NCDA&CS Eastern Region Supervisor, reported the following data for the quarantine log in 2015 (Table 18).



Figure 42 Methyl bromide application at the Cherry Research Station in Goldsboro, NC.

Table 18 Tropical Spiderwort Quarantine Visitor Sign-Ins and Wash Station Log, 2015.

Month	Visitor Sign-Ins	Wash Stations Log
January	51	18
February	66	18
March	109	18
April	162	54
May	183	137
June	281	160
July	324	108
August	136	225
September	119	56
October	335	127
November	77	18
December	63	22
Total Sign-Ins	1,906	961

Giant Salvinia (*Salvinia molesta*)

Giant salvinia, a Federal Noxious Weed, was detected at an aquatic nursery display at the North Carolina State Fair in 1998, and subsequent surveys by NCDA&CS, NCDENR, and NCSU personnel resulted in detections in 26 counties in North Carolina. All of these infestations have been eradicated, however, in September 2000, naturalized infestations of giant salvinia were detected in golf course ponds in New Hanover County and in a canal and wetland at the River bend near Burgaw in Pender County. Acting under the authority of the Aquatic Weed Control Act of 1991, NCDENR Water Resources personnel began herbicide treatments at these sites in November, 2000. A survey of the Northeast Cape Fear River and adjacent wetlands at the Pender County site in 2005 and 2007 yielded no new finds of giant salvinia. Survey and monitoring of the River Bend site in Pender County is ongoing.

A biological control program for giant salvinia at the Pender County site was initiated in 2004 with two releases of the Salvinia Weevil (*Cyrtobagous salviniae*) in June and September. Observations throughout 2005 confirmed the successful overwintering and survival of the salvinia weevil in Pender County, but this biocontrol effort was not deemed appropriate as we approached eradication of this plant and the biocontrol program was discontinued in 2008.

The current status of giant salvinia in North Carolina is that there are no known populations. The Giant Salvinia Task Force is still consulted for technical advice on program activities, but the North Carolina Department of Environment and Natural Resources and the NCDA&CS work together to monitor the situation. A broad survey is planned for 2015 because new populations have recently been found in South Carolina locations that had previously been declared eradicated.

Witchweed (*Striga asiatica*)

Witchweed, a Federal Noxious Weed, is an obligate parasite which attacks corn, sorghum, millet, and other warm season crops in the grass family. Heavy infestations of Witchweed can eliminate yield from these crops, resulting in devastating economic losses. The presence of this quarantined pest also imposes a regulatory burden on crop production and on the movement of farm commodities, equipment, and other regulated articles. The Witchweed Eradication Program includes an organized and effective set of survey, control and regulatory procedures developed through early USDA-APHIS research.



Figure 43 Area of severe witchweed infestation in Cumberland County, NC in November 2014. The witchweed population was so dense that it caused yield loss in the sorghum (indicated by lack of seedheads in the field – foreground).

Specific objectives of the program include: 1) characterization of the infestation through survey; 2) control of existing infestations; and, 3) containment by preventing the movement of potentially infested articles out of established quarantine boundaries.

Survey – Survey is necessary to detect and verify the extent of witchweed (Detection and Delimiting surveys), evaluate the effectiveness of eradication treatments on infested properties (Appraisal surveys), and verify eradication of witchweed on sites released from quarantine (Released surveys). Additional survey of terminated acreage is required in order to confirm the long-term effectiveness of the eradication program. Survey is done through the growing season after host plants have started to grow from about the middle of June through the end of October or until the first frost.

Control – The objective of control treatments is to prevent witchweed seed production and eliminate witchweed seed from the soil. Herbicide treatments, hand pulling and disking help to control witchweed host plants and witchweed plants before they can flower and produce seed. Ethylene applications also help to deplete soil reserves of witchweed seed by encouraging germination and subsequent control by exposure to treatments or a non-host crop. Control treatments can be completed during the growing season and into the winter months provided soil moisture and temperature are favorable for soil fumigation.



Figure 44 NCDA&CS employees walking a sorghum field scouting for witchweed.

Regulatory

Regulatory activities aid in preventing the artificial spread of witchweed from infested areas to non-infested sites. These regulatory functions facilitate the interstate and intrastate movement of agricultural commodities from witchweed regulated areas.

Witchweed Eradication Program Data Compilation Description

All control treatments and surveys are tracked in a database that updates the status of infested fields and released fields. New or re-infested fields are added to the infested field list when witchweed is confirmed in new fields or fields that have been previously released. A point system was developed for the program that provides a quantitative measure for moving fields from infested to a released status and from a released status to a terminated status. Infested fields are assigned points depending on the nature of the field and the control activities that were done on it during the season. Once a field accrues five points it is advanced to “Release” status which means it is surveyed on a schedule for a minimum of 10 years and assigned either 0.5 points for a spot survey or 1.0 points for a general survey. Once a field acquires 10 points it is terminated from the program.

The following summary tables show the status of acreage in North Carolina and South Carolina as of the end of the 2014 survey and treatment season. Since point values for a field are adjusted only once at the

end of the growing season, it is not possible to obtain an accurate end of season account of field status until survey and treatment have ended for the year.

Following is a description of year end activities that are required to summarize year end data:

- A “switchboard” routine is executed in the database that automatically increments point values for released fields to account for surveys done on them during the season.
- Based on input from each inspector, infested field point values are manually adjusted to reflect current field conditions and treatments that were done during the year. In most instances fields will be advanced in point value. Some fields may qualify for release based on reaching a point value of 5. Infested field point value at the end of the season is a judgment based on knowledge of witchweed biology, field treatments and current field conditions and can be discussed with the program manager. The new field values are assigned at the end of the growing season after the first frost when it is assumed no more treatments for the year will be implemented and no new witchweed will be found.
- New fields are added to the data base and are assigned a new farm and/or field number. Re-infested field point values are changed to bring them back to values less than 5 so that they will be tallied as infested fields.
- After the end of growing season adjustments, the data base is queried and standard reports are generated that provide updated statistics for acres infested, released, surveyed and treated.

Summary of Results







This report contains the following Witchweed Status Data Tables and Figures for 2014. Values for 2013 are shown for comparison.

- Infested Acres in Quarantined Counties by Point Value (Table 19)
- Number of Infested Farms and Fields with Fewer Than 5 Points by County (Table 20)
- Released Acreage in Quarantine Counties (Table 21)
- Summary of Treatment Acreage by Crop Type (Table 22)
- Summary of Treatment Acreage by Treatment Method (Table 23)
- Summary of Surveyed Acreage (Table 24)
- Acreage Status (Table 25)
- Other Statistics (Table 26)
- Figures showing 2014 Witchweed Finds by County (Figure 45 - Figure 49)

Table 19 Infested Acreage By Point Value in each Quarantined County for 2013 and 2014.








County		0-0.9 Acres	1-1.9 Acres	2-2.9 Acres	3-3.9 Acres	4-4.9 Acres	Infested Acres
Bladen	2013	89.10	183.80	120.70	78.50	10.20	482.30
	2014	183.60	100.60	149.30	64.40	53.20	551.10
Cumberland	2013	71.20	10.90	35.10	42.80	344.50	504.50
	2014	71.20	0.00	10.90	73.10	170.40	325.60
Pender	2013	0	8.50	0	0	4.00	12.50
	2014	0	6.00	2.50	0	0	8.50
Robeson	2013	0	0	0	8.00	228.60	236.60
	2014	8.70	0	0	0	223.80	232.50
Sampson	2013	0	12.30	0	4.00	3.70	20.00
	2014	0	0	12.30	0	4.30	16.60
Total	2013	160.30	215.50	155.80	133.30	591.00	1,255.90
	2014	263.50	106.60	175.00	137.50	451.70	1,134.30

Table 20 Number of Infested Farms and Fields by County for 2013 and 2014.

County		No. of Farms	No. of Fields	Infested Acres	
Bladen	2013	32	49	482.30	
	2014	36	57	551.10	
Cumberland	2013	44	60	504.50	
	2014	35	43	325.60	
Pender	2013	1	3	12.50	
	2014	1	2	8.50	
Robeson	2013	16	20	236.60	
	2014	14	19	232.50	
Sampson	2013	5	5	20.00	
	2014	4	4	16.60	
Total	2013	98	136	1,255.90	
	2014	90	125	1,134.30	

NOTE: Down is good

Table 21 Released acreage by point value and county for 2013 and 2014.

County		5-5.9 Acres	6-6.9 Acres	7-7.9 Acres	8-8.9 Acres	9-9.9 Acres	Released Acres	
Bladen	2013	198.30	22.70	303.50	542.30	1,776.40	2,843.20	
	2014	159.70	31.50	41.70	587.40	579.10	1,399.40	
Columbus	2013	0	0	0	48.80	36.50	85.30	
	2014	0	0	0	0	85.30	85.30	
Cumberland	2013	339.40	56.90	208.10	480.20	613.20	1,697.80	
	2014	507.20	11.10	196.50	339.20	451.70	1,505.70	
Pender	2013	4.60	0	0	0	52.00	56.60	
	2014	45.50	0	0	0	2.50	48.00	
Robeson	2013	133.40	103.80	78.90	1,071.70	993.60	2,381.400	
	2014	143.10	14.70	144.20	235.20	1,406.60	1,943.80	
Sampson	2013	15.40	11.00	3.70	143.50	91.20	264.80	
	2014	18.80	0	14.701	32.40	202.30	268.20	
Total	2013	691.10	194.40	594.20	2,286.50	3,562.90	7,329.10	
	2014	874.30	57.30	347.10	1,194.20	2,727.50	5,250.40	







NOTE: Down Is Good.**Table 22** Summary of Treated Acreage by Crop Type for 2013 and 2014.

Crop Name		No. of Acres Treated
Corn	2013	1,308.10
	2014	604.55
Soybean	2013	911.71
	2014	539.90
Idle	2013	686.36
	2014	836.00
Other	2013	464.90
	2014	566.86
Total Crop Acres Treated		2013 3,371.07
		2014 2,547.31

Table 23 Summary of Acres by Treatment Type

Treatment Type	No. of Acres Treated	No. of Treatments
Disking	787.00	107
Ethylene (Tractor and Hand)	432.52	76
Hand Pulling	286.78	250
Herbicide to Host	967.30	73
Herbicide to Witchweed	44.11	25
Herbicide (Survey Aid)	29.60	7
Total Acres Treated	2,547.31	538

Table 24 Summary of Surveyed Acreage for 2013 and 2014

Category		Total Acres	
Appraisal	2013	12,456.90	
	2014	10,140.80	
Release	2013	16,068.10	
	2014	19,809.80	
Delimiting	2013	36,320.70	
	2014	42,423.50	
Detection	2013	6,294.20	
	2014	5,361.70	
Regulatory	2013	0.00	
	2014	0	
Total Acres Surveyed	2013	71,139.90	
	2014	77,735.80	

NOTE: Down Is Bad.

Table 25 Acreage Status for 2013 and 2014

	2013	2014
Total Acres in Infested Category	1,255.90	1,134.30
Total Acres in Released Category	7,329.10	5,250.40
Total Acres Managed by Program	8,585.00	6,384.70
Total Acres Treated	3,371.07	2,547.31
Total Acres Surveyed	71,139.90	77,735.80
Acres Transferred from Infested to Release Category	466.90	287.50
Acres New or Re-Infested	<u>- 49.40</u>	<u>- 176.00</u>
Net Gain in Eradicated Acres	417.50	111.50
Acres transferred from Release to Terminated Category	Not Collected	2,231.40

Table 26 Other Statistics for 2013 and 2014

	2013	2014
Acres Treated by Contract	0	0
Counties now Infested in North Carolina	5	5
Number of Witchweed Bounty Payments	11	12
Associated Witchweed Bounty Acreage	121.5	137.2
Number of Witchweed Infested Fields with Witchweed Sightings	73	65
Total Number of Witchweed Observations	178	209
Number of Phytosanitary Certificates Issued	97	77

The following maps contain GPS collected data points for counties containing quarantined Witchweed fields. Data points were collected in 2012, but remain accurate for 2014.

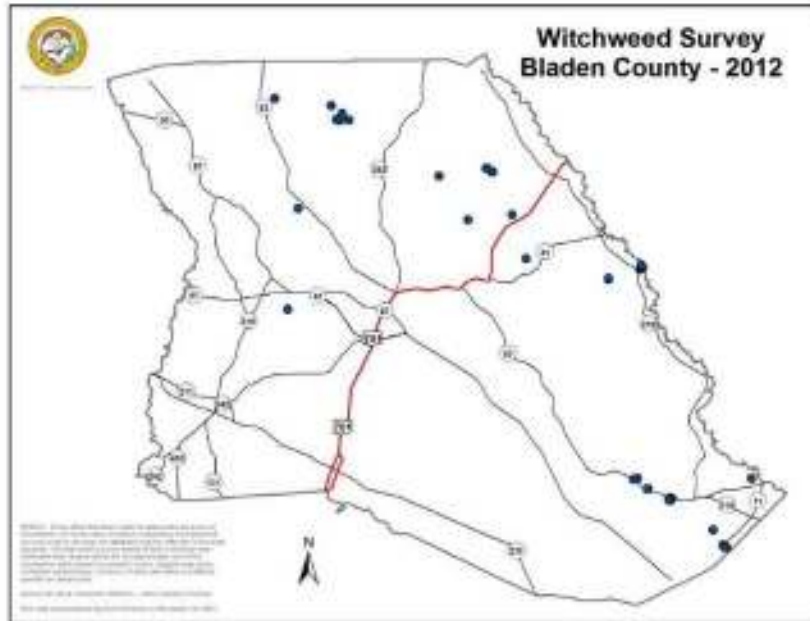


Figure 45 Bladen County Confirmed Witchweed Locations.

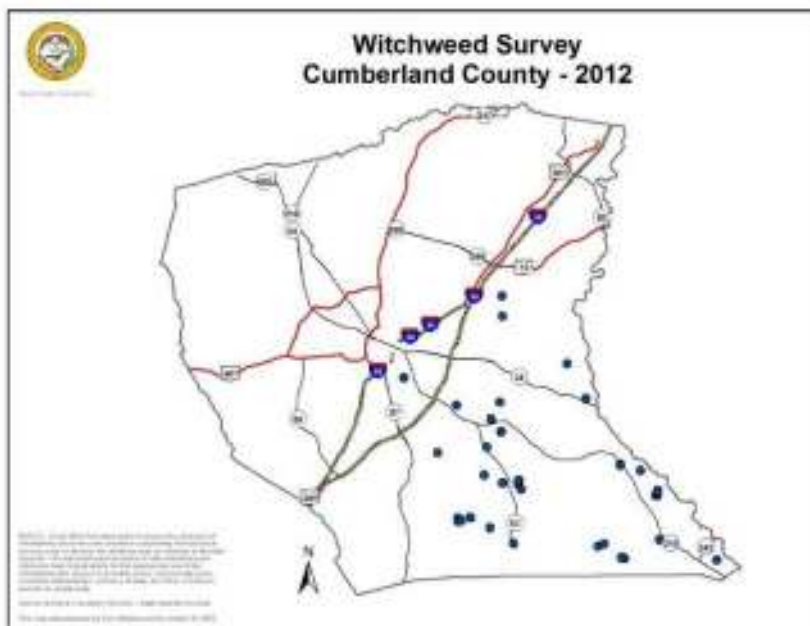


Figure 46 Cumberland County Confirmed Witchweed Locations.

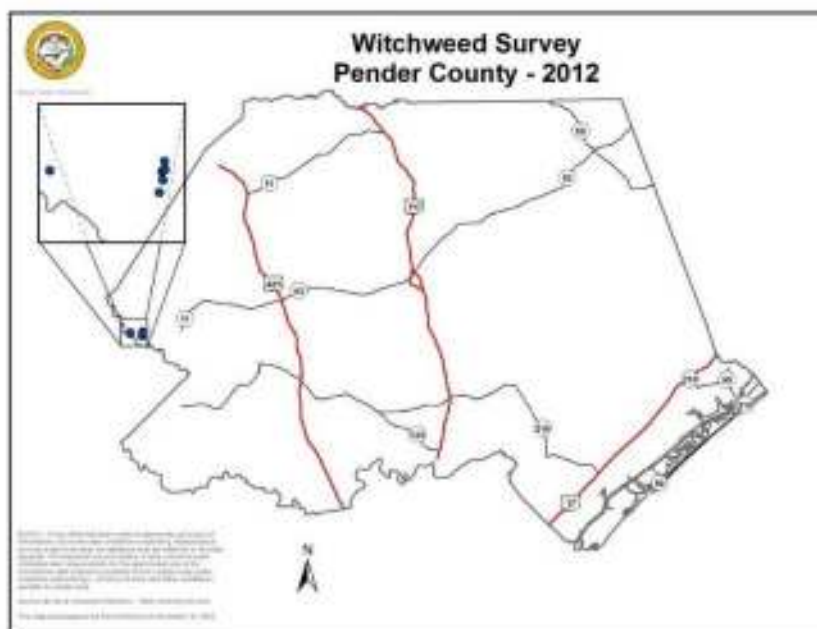


Figure 47 Pender County Confirmed Witchweed Locations.

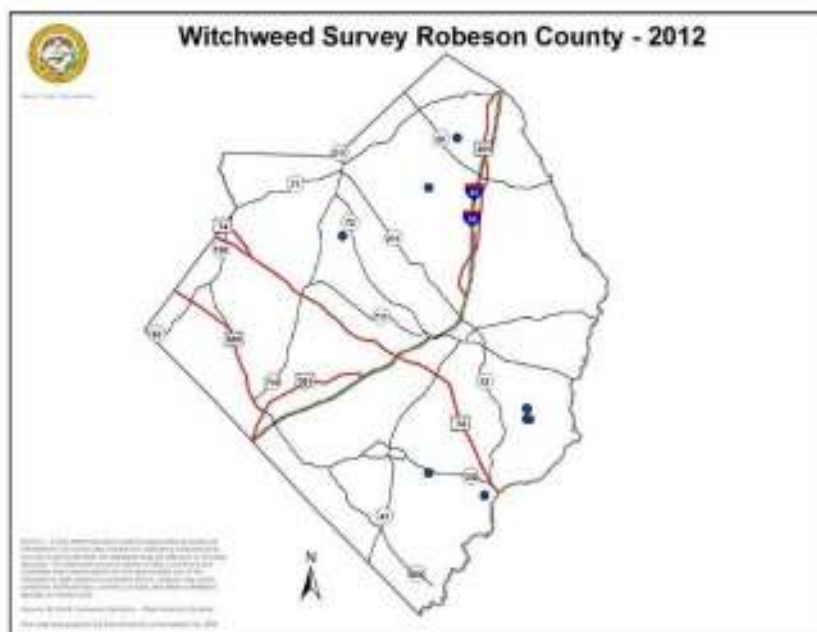


Figure 48 Robeson County Confirmed Witchweed Locations.

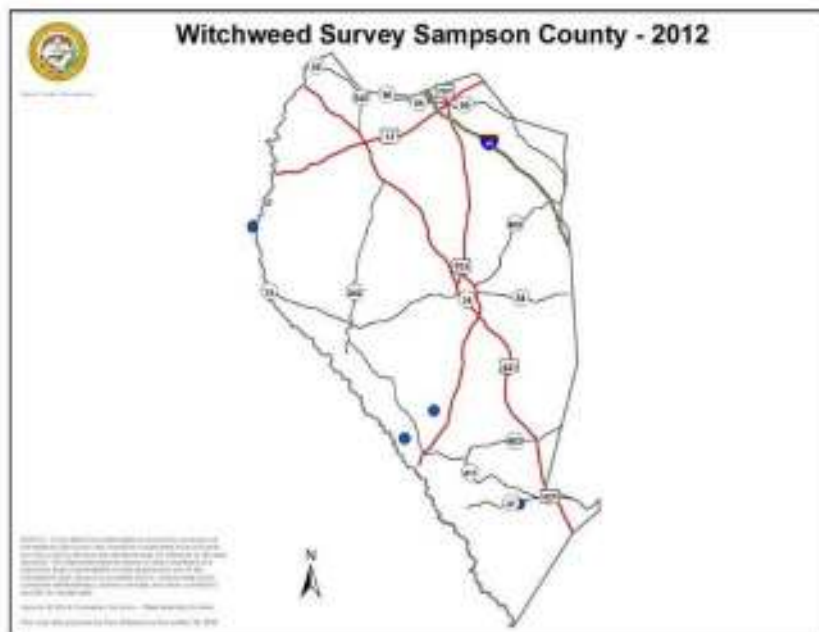


Figure 49 Sampson County Confirmed Witchweed Locations.

ACCOMPLISHMENTS: SEED AND FERTILIZER SECTION

The mission of the Seed and Fertilizer Section is to improve the profitability and sustainability of agriculture in the state by ensuring the seed, fertilizer, lime, and other soil additives offered for sale in North Carolina meet prescribed standards and are properly labeled.

The mission of this section is accomplished by:

- Ensuring that all locations that offer seed, commercial fertilizers, agricultural liming materials, landplaster, and soil additives for sale in the state are registered.
- Implementing a sound regulatory compliance program by conducting inspections and sampling of seed and fertilizer offered for sale in the state.
- Implementing seed purity, germination, and other specialized laboratory tests in support of the seed regulatory and service programs.
- Implementing a joint federal/state administered biotechnology permitting and inspection program.
- Conducting the fertilizer bioassay and endophyte testing programs.
- Coordinating activities of the N.C. Seed Board such that complaints regarding the failure of agricultural or vegetable seed to produce or perform as labeled or warranted are heard and responses are provided.

The Seed and Fertilizer Section includes 25 staff members with responsibilities and accountability for administration, field services and North Carolina Seed Lab functions. The total budget for the Seed and Fertilizer Program for 2013-14 was \$1,525,602 including a state appropriation of \$644,237 and receipts of \$914,380. Revenues included receipts from licenses, registration fees, and tonnage fees.

Seed and Fertilizer Field Programs

During the fiscal year 2013-14 the Seed and Fertilizer Section remained very active providing services to producers and individuals within North Carolina and some service to non-residents of the state. Administrative staff was responsible for issuing 4,662 licenses for business that sold wholesale and retail seed. During the 2013-14 fiscal year 531 fertilizer licenses were issued to companies manufacturing or distributing fertilizer products. These products were sold through chain and private retail outlets and through 215 farm supply outlets.

Seed and Fertilizer Field Staff are responsible for conducting inspections and sampling seed and fertilizer offered for sale in the state. The staff also implements a regulatory program to ensure full compliance with laws and regulations. An overview of program accomplishments is provided in Table 27.

Seed and Fertilizer Field Staff also provided support to the North Carolina Department of Transportation by collecting 151 samples from 34 seed lots to be utilized on highway projects. The lab tests performed on these seed lots detected several violations and as such remain a critical part of the program.

Commodity prices on all major crops generally remained above the long-term average and this was reflected in additional tonnage being applied. Along with traditional fertilizers, producers also took advantage of animal and poultry waste to provide nutrients to their crops.

Table 27 2013-14 Seed and Fertilizer Program Inspection and Regulatory Activities

Number of Seed and Fertilizer Dealer Visits:	6,271
Seed and Fertilizer Samples collected	
Official Seed Samples	2,305 (50,363 lots)
Official Fertilizer/Lime Samples	2,129 (32,292 lots)
Regulatory Compliance Program	
Seed Stop Sales Issued	49
Seed Stop Sales Issued and Resolved on Site	1,268
Seed Stop Sales (N.C. Seed Lab)	208
Fertilizer Stop Sales Issued	15
Fertilizer Stop Sales Issued and Resolved on Site:	52

Table 28 and Table 29 provide additional information on fertilizer and lime samples taken by field staff and subsequently analyzed to ensure compliance with applicable statutes and regulations.

Table 28 Data of fertilizer samples analyzed for the current and previous fiscal years

FERTILIZER SAMPLING AND TONNAGE						
<u>Year</u>	<u>#Samples</u>	<u>#Compliant</u>	<u>%Compliant</u>	<u>Tonnage Reported</u>	<u>Tonnage Sampled</u>	<u>%Sampled</u>
2013-14	1,374	1,058	77.00	1,509,378	22,309	1.48
2012-13	1,228	868	70.68	1,378,111	21,920	1.59
2011-12	1,195	876	73.31	1,243,164	56,762	1.5
2010-11	1,437	1,019	70.90	1,295,362	33,170	2.56
2009-10	1,651	1,141	69.11	1,251,026	26,539	2.12
2008-09	1,484	1,069	72.52	1,073,286	35,598	3.32

Table 29 Data of lime and landplaster samples analyzed for the current and previous fiscal years.

LIME SAMPLING AND TONNAGE						
<u>Year</u>	<u>#Samples</u>	<u>#Compliant</u>	<u>%Compliant</u>	<u>Tonnage Reported</u>	<u>Tonnage Sampled</u>	<u>%Sampled</u>
2013-14	646	498	77.00	831,854	28,620	3.44
2012-13	692	615	88.87	825,596	33,941	4.11
2011-12	758	541	71.37	767,766	36,965	4.8
2010-11	895	724	80.90	793,925	43,680	5.50
2009-10	729	611	83.81	640,106	35,793	5.59
2008-09	871	720	82.66	687,605	43,295	6.3

During 2014, one legislative change was made to limit the authority of local governments to regulate the “use, sale, distribution, storage, transportation, disposal, formulation, labeling, registration, manufacture or application of fertilizer. ([N.C.G.S 106-678](#)).

N.C. Seed Laboratory

The North Carolina Seed Laboratory is responsible for providing laboratory support for both the regulatory and service areas including the state’s seed dealers, producers, university researchers and consumers. The work of this laboratory provides critical seed testing data needed to make management decisions regarding seed stock and for labeling purposes. For 2013-14, the North Carolina Seed Laboratory conducted 3,508 regulatory seed tests and 11,491 service seed tests. These tests involve required testing for purity and germination. Multiple tests are generally conducted on each of the samples submitted with 14,999 individual tests carried out. Additional special tests included tetrazolium, accelerated aging, cool test of cotton, cold test of hybrid corn, phenol, Round-up Ready™ tolerance, sand, and moisture testing. There were 653 special tests conducted during the fiscal year. All official regulatory samples taken during the fiscal year 2013-14 represent testing for a total of 49,062,993 pounds of seed offered for sale in North Carolina. See Figure 50 and Figure 51 for more information on the various seed tests performed in the laboratory.

The Seed and Fertilizer Section continued to implement the endophyte testing service. A number of grasses, including tall fescue and perennial ryegrass, contain a fungal endophyte which has a beneficial relationship with the grass host. The tall fescue endophyte, *Neotyphodium coenophialum* (previously *Acremonium coenophialum*), lives exclusively inside plants, and can only be detected through laboratory analysis. This endophyte has been proven to give the plant insect, disease and drought resistance, as well as enabling the plant to be more tolerant of overgrazing. Though very beneficial to tall fescue plants, this endophyte produces chemicals which are toxic to a variety of animals. In North Carolina, fescue toxicosis is especially a problem in horses and cattle. A total of 20 pasture samples were processed for producers, both in-state and out-of-state.

The staff of the North Carolina Seed Laboratory remains active in the Association of Official Seed Analysts and the Association of American Seed Control Officials. At the state level, program staff remains active in the North Carolina Seedsmen’s Association and the North Carolina Crop Improvement Association.

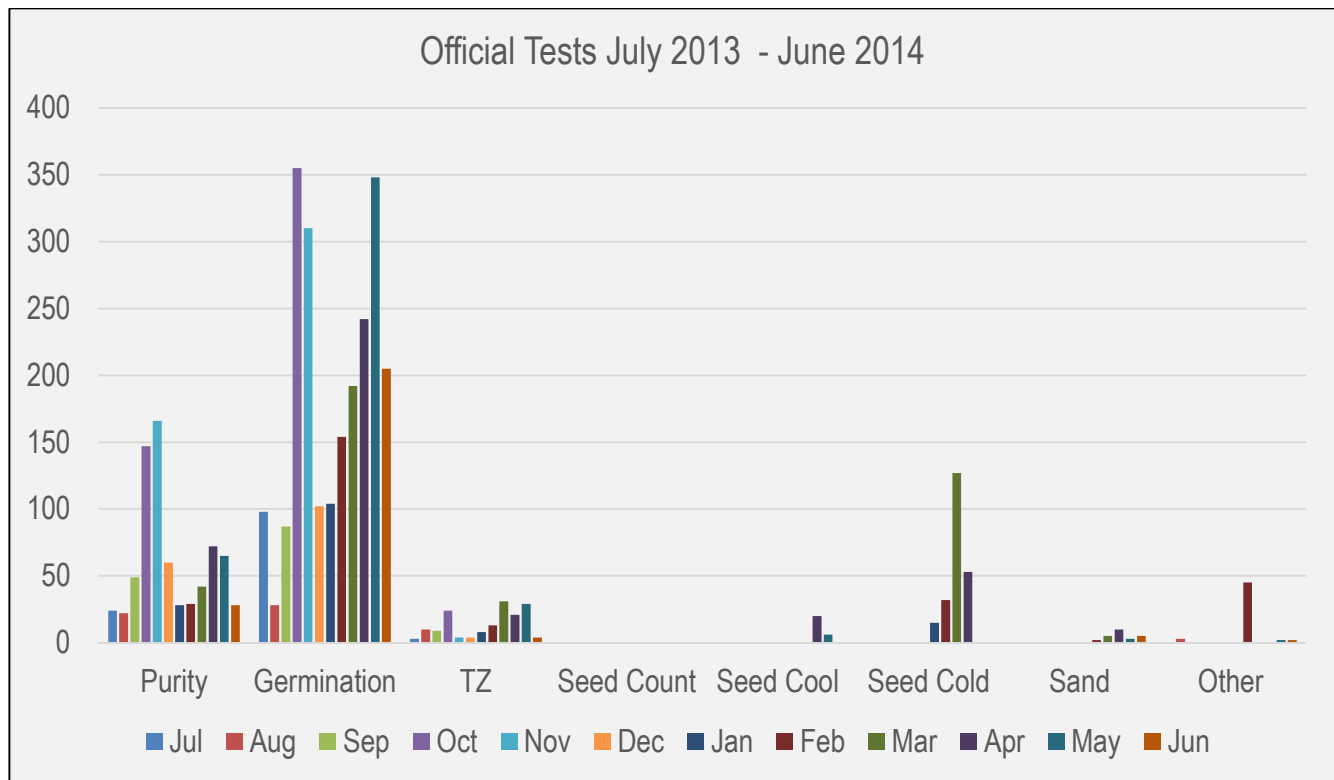


Figure 50 Seed Laboratory Official Tests

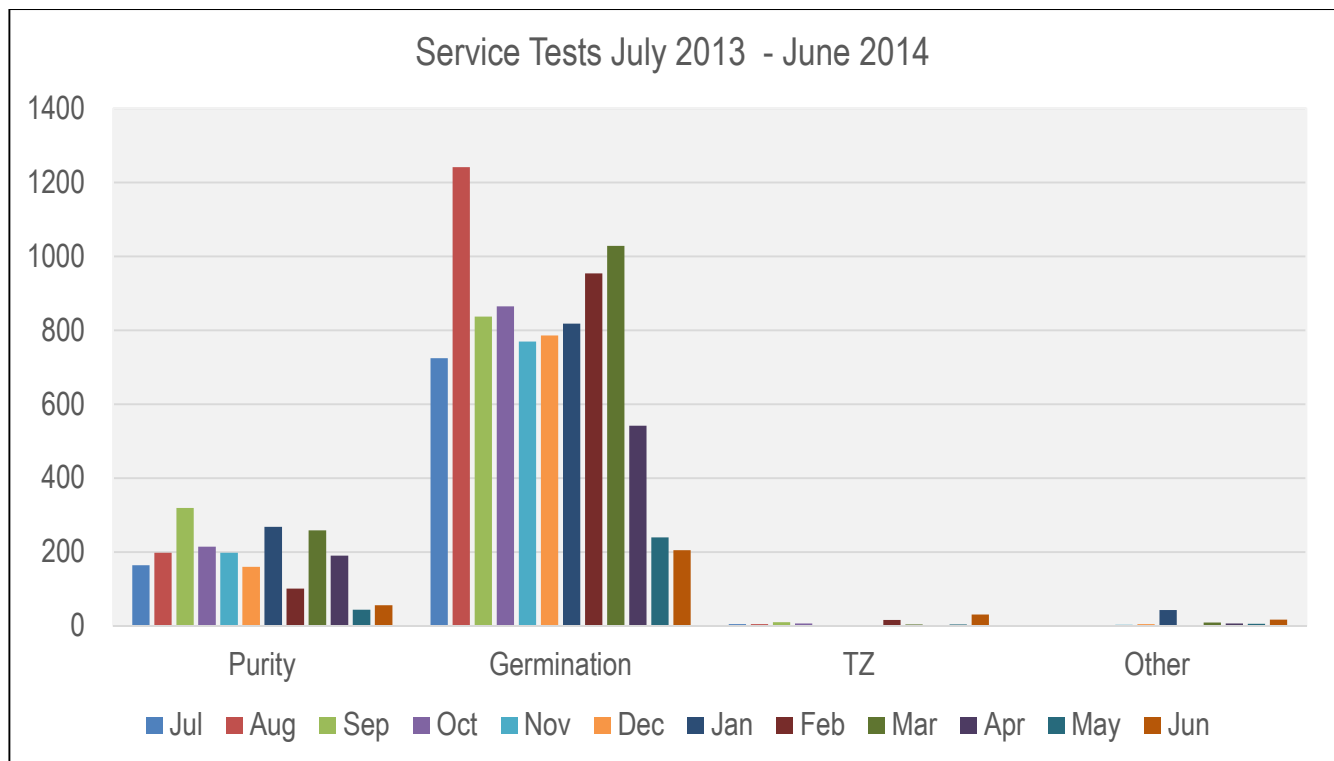


Figure 51 Seed Laboratory Service Tests

Joint Collaboration with USDA, Biotechnology Regulatory Services

Seed and Fertilizer Section staff worked with USDA, Biotechnology and Regulatory Services (BRS) to jointly administer a federal/state biotechnology and permitting program. Primary responsibilities included reviewing permits and acknowledgements provided through USDA-BRS for laboratory, greenhouse, and field tests of genetically engineered crops. For this period, NCDA&CS staff reviewed a total of 329 notifications and permits. A joint project with USDA-BRS continued during this period involving NCDA&CS staff conducting field inspections of *Notification and Permit Release Sites*, including pharmaceutical/industrial trials. During this time period there were 6 field inspections conducted by NCDA&CS field staff. As a prerequisite for participation in the project, all field staff were required to participate in training conducted by USDA-BRS focusing on work flow, confidential business information, and steps in effectively completing a field inspection.

North Carolina Seed Board

The responsibility of the North Carolina Seed Board is to review complaints from individuals who may have suffered damage from the failure of agricultural or vegetable seed to perform as labeled or warranted, or as a result of negligence. Performance issues related to seed purity, seed germination, varietal purity, percent weeds, inert material, other crop seed and test date are potential issues to be addressed by the Seed Board. For the 2013-14 fiscal year time period, no complaints were filed with the Seed Board.

North Carolina Tobacco Variety Evaluation Program

The Tobacco Variety Evaluation Program continued in joint cooperation with N.C. State University. Samples from 33 flue-cured tobacco seed lots were obtained for planting grow-outs in the variety testing program. All seed lots tested were found truthfully labeled as to variety and recommended for sale by the committee.